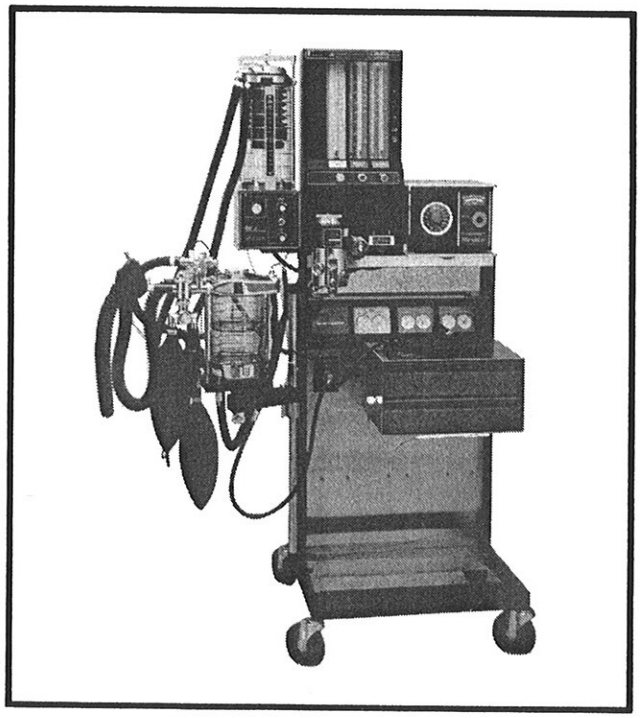
Ohio Medical Products

OM

OPERATION MAINTENANCE

Modulus™

Anesthesia Gas Machine



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CAUTION: Federal law in U.S.A. and Canada restricts this device to sale by or on the order of a licensed practitioner.

User Responsibility

This Product will perform in conformity with the description thereof contained in this operating manual and accompanying labels and/or inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided. This Product must be checked periodically. A defective Product should not be used. Parts that are broken, missing, plainly worn, distorted or contaminated, should be replaced immediately. Should such repair or replacement become necessary, Ohio Medical Products (Ohio) recommends that a telephonic or written request for service advice be made to the nearest Ohio Regional Service Center. This Product or any of its parts should not be repaired other than in accordance with written instructions provided by Ohio, or altered without the prior written approval of Ohio's Safety Department. The user of this Product shall have the sole responsibility for any malfunction which results from improper use, faulty maintenance, improper repair, damage, or alteration by anyone other than Ohio.

Precautions

Warnings

The Link-25™ Proportion Limiting Control System ensures that only oxygen-nitrous oxide mixtures will have at least a nominal 25% oxygen concentration. HYPOXIC MIXTURES MAY BE DELIVERED IF GASES OTHER THAN OXYGEN, NITROUS OXIDE, AND/OR AIR ARE USED. See Pages 3 and 22. Also see page 8 of the OM manual for the Complete Verni-Trol Anesthetic Vaporizer Option (0178-1701-000) if the machine has this equipment.

The Modulus Anesthesia Gas Machine is restricted to use with non-flammable anesthetic agents. See Page 5.

Hypoxic mixtures may be delivered if gases other than oxygen, nitrous oxide, and/or AIR are used. See Page 10.

A manifold cap must be installed in the absence of a vaporizer, or all gas flow may be vented to the atmosphere and prevent metered gases from reaching the patient. See Pages 11 and 16.

Leakage of gases and vapors to the atmosphere from gas circuits of the anesthesia machine (downstream of the flow control valves and oxygen flush valve) may deprive the patient of metabolic gases and anesthetic agent and may pollute the atmosphere. Tests which detect such leakage must be performed frequently. If detected, leakage must be reduced to an acceptable level. It is recommended that the Low Pressure Leak Testing Device be kept with the anesthesia machine at all times. See Page 12.

Do not tilt any vaporizer more than 45 degrees while it contains liquid anesthetic agent. Use of the vaporizer after such tilting may cause dangerously high concentrations of anesthetic agent to be delivered to the patient. Consult the appropriate vaporizer OM manual for details on this and other precautions regarding the use of a vaporizer. See Page 15.

Do not leave oxygen cylinders open when the pipeline supply is in use and the Machine ON-OFF switch is in the ON position. Pressures from both oxygen supplies may become equal, and if simultaneously used, cylinder supplies could be depleted, leaving no reserve supply in case of pipeline failure. See Page 22.

The oxygen flow control valve is preset to allow a minimum flow of 200 ml/min. To prevent depletion or waste of the oxygen supply always remember to place the Machine ON-OFF switch in the OFF position when the machine is not in use. See Page 22.

Do not use the anesthesia machine after performing the low pressure leak test until the vaporizer circuits have been purged with oxygen. See Page 24.

Never oil or grease any anesthesia or oxygen equipment unless the lubricant used is made and approved for this type of service. In general, oils and greases oxidize readily, and in the presence of oxygen, they will burn violently. Vac Kote is the oxygen service lubricant recommended for use. Never cover an anesthesia machine with any type of fabric or plastic covering. Removal of the cover may cause static electricity with the possibility of a resultant fire or explosion. See Pages 26 and 32.

Gaining access to the flowmeter modules and FCM high pressure hose connections will expose other circuitry and components of the FCM. Never tamper with or attempt to adjust any part of the circuitry unless specific instructions are provided in this manual. To do so may affect the safe operation of the anesthesia machine. See Page 28.

Failure to plug a vacant distribution manifold inlet will result in loss of some or all gases from the machine circuitry, because gas from a flowmeter module outlet flows into the common passage of the gas distribution manifold. See Page 31.

Do not use silicone grease sealants or silicone leak detecting fluids in association with halogenated anesthetic agents. For further explanation of this warning see the Complete Verni-Trol Anesthetic Vaporizer Option OM manual (0178-1701-000).

Precautions

Cautions

Use only one cylinder gasket per yoke. Inadvertent use of more than one gasket could cause leakage of the cylinder gas. See Page 15.

Yoke check valves may not provide a leak free seal. Always use yoke plugs to seal an unused yoke. See Page 15.

Do not exceed the height adjustment or weight maximums specified in the installation instructions provided with each monitor rack. See Page 20.

Do not begin daily use of the Modulus Anesthesia Gas Machine until the Preoperative Checklist has been reviewed and all relevant checkout tests procedures have been performed. See Page 21.

Make sure that all flow control valves are turned fully clockwise to their stops before the Machine ON-OFF switch is placed in the ON position. No gases will flow before sufficient oxygen pressure is provided. If the flow control valves of any gases are not turned to their stops, the flowmeter module may be damaged by the sudden onset of flow when the Machine ON-OFF switch is placed in the ON position. See Page 22.

The headings [of the Preoperative Checklist] are printed on a plastic card located under the upper drawer cabinet. The card should be reviewed and all relevant checkout test procedures performed daily. See Page 23.

Open the cylinder valves slowly to avoid damaging the regulators. See Page 24.

No repair should ever be undertaken or attempted by anyone not having general experience in the repair of devices of this nature. See Page 26.

The flowmeter modules themselves must never be disassembled. Each module has a seal which, if broken, indicates that tampering has occurred. Tampering with a flowmeter module violates the terms of the user responsibility clause. See Page 30.

A flowmeter module requiring repairs must not be used and must be replaced. See Page 30.

If the flowmeter module in need of repair is for either oxygen or nitrous oxide, and no replacement module is available, the machine must not be used. See Page 30.

Talc, zinc, stearate, or starch which have been used to prevent tackiness of rubber articles could contaminate a patient's respiratory tract. See page 32.

Following sterilization with ethylene oxide, parts should be quarantined in a well ventilated area to allow dissipation of residual ethylene oxide gas absorbed by the rubber. In some cases, aeration periods of seven days or more may be required. Aeration time can be decreased when special aeration devices are used. Follow sterilizer manufacturer's recommendations for specific aeration periods required. See Page 33.

1/Specifications

Stand: rigid steel and aluminum construction.

Drawer Cabinet: stainless steel jacket providing a 11½"x15½" (29.2 cm x 39.3 cm) top surface and either one 8" (20.3 cm) or two 4" (10.1 cm) locking, rubber lined, ball bearing slide drawers.

Gas Supply Modules: labeled for the gas supplied and integrating:

- DISS (diameter index safety system) coded pipeline inlet connections for 50 psig gas supply lines.
- safety pin-indexed, locking gate style, cylinder hanger yokes.
- cylinder and pipeline gas supply pressure gauges mounted in color coded and labeled plates and dual calibrated as follows:

Cylinder Gauges

0 to 3000 psig and 0 to 200 kg/cm² (0 to 210 kPa)

Pipeline Gauges

0 to 100 psig and 0 to 7 kg/cm² (0 to 7 kPa)

- gas cylinder pressure regulators set at nominal 45 psig (310 kPa) for all gases.
- with safety relief valves set at 120 psig (827 kPa).
- one-way check valves to prevent loss of cylinder gas supply.

Internal Hose Connections: coded DISS high pressure hoses for each gas supplied.

Flow Control Module (FCM): rigid frame with stainless steel protective shroud, recessed control panel and flowmeter shield.

Components include:

- second stage oxygen and nitrous oxide pressure regulators individually factory set during calibration.
- Oxygen Supply Failure Alarm which sounds when oxygen pressure drops to below nominal 30 psig [207 kPa] (and is sustained for a minimum 7 seconds when the flow is equal to or less than one third of the calibration range).
- Pressure Sensor Shutoff Valve system which shuts off all gas flow before oxygen pressure falls to 20 psig (138 kPa).
- Machine ON-OFF switch which is a pneumatic valve and when ON allows oxygen flow for gas distribution.
- flow control valves with symbol and color coded control knobs, a touch coded oxygen control knob, preadjusted stops and silver seats.
- Link-25 Proportion Limiting Control System which links the oxygen and nitrous oxide flow control valves and limits minimum oxygen flow to a nominal 25% of the oxygen nitrous oxide mixture.

WARNING: The Link-25™ Proportion Limiting Control System ensures that only oxygen - nitrous oxide mixtures will have at least a nominal 25% oxygen concentration. HYPOXIC MIXTURES MAY BE DELIVERED IF GASES OTHER THAN OXYGEN, NITROUS OXIDE, AND/OR AIR ARE USED. Also see Page 8 of the OM manual for the Complete Verni-Trol® Anesthetic Vaporizer option (0178-1701-000) if the machine has this equipment.

- single or double flowmeter modules which are safety pin-indexed, have long, color coded scales labeled with gas symbols, are individually hand calibrated, are provided with tamper proof screws and seals which, if broken, indicate disassembly.

Calibration Ranges

Single flowtube for O_2	200 ml/min-6L/min
Double flowtube for O_2 (connected in series)	200 ml/min-600ml/min 700 ml/min-6L/min
NOTE: A stop on the oxygen flow control valve prohibits a flow of less than 200 ml/min of oxygen.	
Single flowtube for N_2O	200 ml/min-12L/min
Double flowtube for N_2O (connected in series)	700 ml/min-12L/min 20ml/min-600ml/min
Flowtube for AIR	1-15 LPM
Flowtube for CO_2	20-700 ml/min
Flowtube for He	200ml/min-10L/min

A transparent plastic shield fits in front of the flowmeter modules to protect them from damage.

- Oxygen Flush which is a self closing pushbutton, protected against accidental flush and allows a flow of not less than 35 LPM and not greater than 75 LPM when fully depressed.
- Integral three position Vaporizer Selector-Interlock Valve and mounting manifold.
- Oxygen Power Outlet provides oxygen at nominal 50 psig (345 kPa) to power an anesthesia ventilator.
- Relief valve set at nominal 130mm/Hg to protect the FCM circuitry against excessive pressure.

Absorber Post: equipped with a swivel arm mounting assembly allowing movement in a 15½" (39.5cm) horizontal arc; height is pushbutton adjustable in a range of 24-48 inches (61-122cm) from the floor.

Machine Outlet Panel: includes the common 22mm OD taper, 15mm ID gas outlet, a blood pressure gauge Luer-Lok connection and an Ohio oxygen monitor locking male connector.

Monitor Rack: shelves are equipped with Velcro* straps to secure monitoring equipment.

* Trademark of Velcro Corporation

2/Description

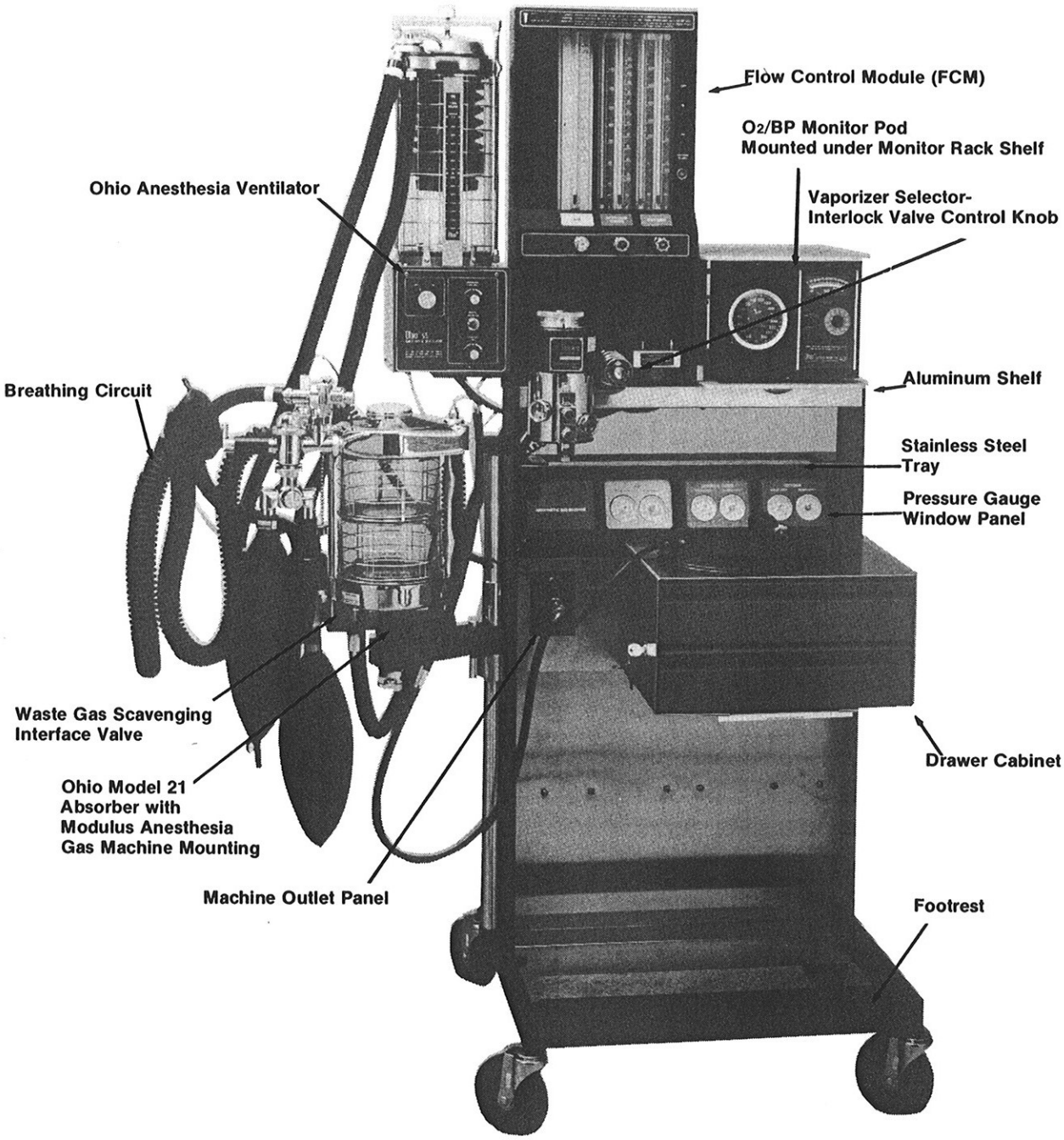


Figure 1.
Modulus Anesthesia Gas Machine, Standard Model (with three gases), Left Hand Mount with: Ventilator, Absorber, Breathing Circuit, Rack Mounted O_2/BP Monitor Pod, Vaporizers and Waste Gas Scavenging Interface Valve

2/Description

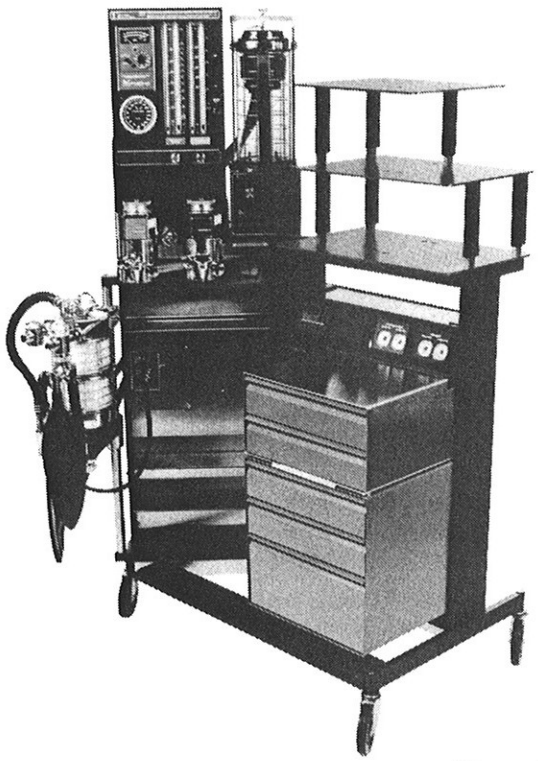


Figure 1a.
Modulus Anesthesia Gas Machine, Wing Model (with Two Gases), Left Hand Mount with: Ventilator, Absorber, Breathing Circuit, Flow Control Module mounted O_2/BP Monitor Instrument Panel, Vaporizers, Waste Gas Scavenging Interface Valve, additional Monitor Racks and Add-on Drawer Cabinet

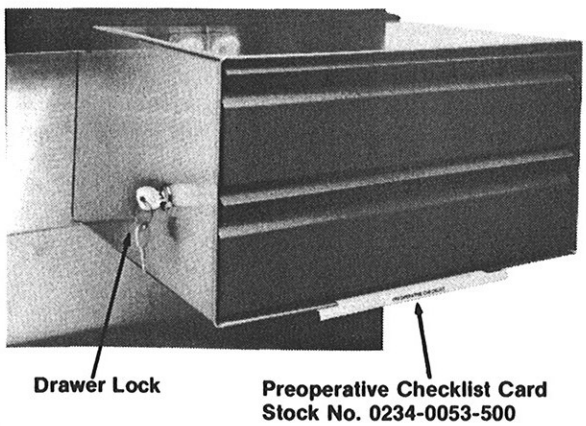


Figure 2.
Drawer Cabinet with Preoperative Checklist Card, Lock and Keys

2.1 General

WARNING: The Modulus Anesthesia Gas Machine is restricted to use with non-flammable anesthetic agents.

The Modulus™ Anesthesia Gas Machine is designed to integrate a set of gas circuitry modules and components into one of several available models. Models are differentiated by framework style, gas supply capability and modular configuration*. Although modular configurations may differ greatly from one machine to another (see Figures 1 and 1a), a basic set of modules and components are the same on all Modulus Anesthesia Gas Machines. A module can be defined as an operative portion of the gas circuitry which:

1. is self contained
2. interfaces with other components or modules
3. can be removed and replaced with relative ease and
4. fits into a predesignated modular space.

In addition to what must be basically furnished, each machine can accommodate a number of options and accessories.

All models are mounted on five-inch ball bearing rubber casters and are provided with an integral foot rest. A drawer cabinet is standard equipment on all machines and houses either one 8" or two 4" locking, rubber lined, ball bearing, slide drawers. The drawer cabinet's stainless steel top provides a 11½" x 15½" (29.2cm x 39.3cm) working surface (see Figure 2).

2.2 Gas Capability

All Modulus Anesthesia Gas Machines have the capability to accommodate up to four gases. Oxygen and nitrous oxide are always provided. AIR, carbon dioxide, or helium may be selected as third or fourth gases. Machines not ordered with circuitry for a third or fourth gas can have the appropriate modules and circuitry field installed in the unused "modular space".

NOTE: Installation of additional gas supplies and circuitry can be done by an Ohio Medical Products Service Representative only.

NOTE: The schematic representations shown in Figures 18 and 19 (foldout from page 21) may be referred to for the following discussion of Modulus Anesthesia Gas Machine modules, components and gas circuitry. They will also be helpful references when reading the Setup and Operation sections.

* See Sales brochure Form No. 9940 for more information on models available.

2/Description

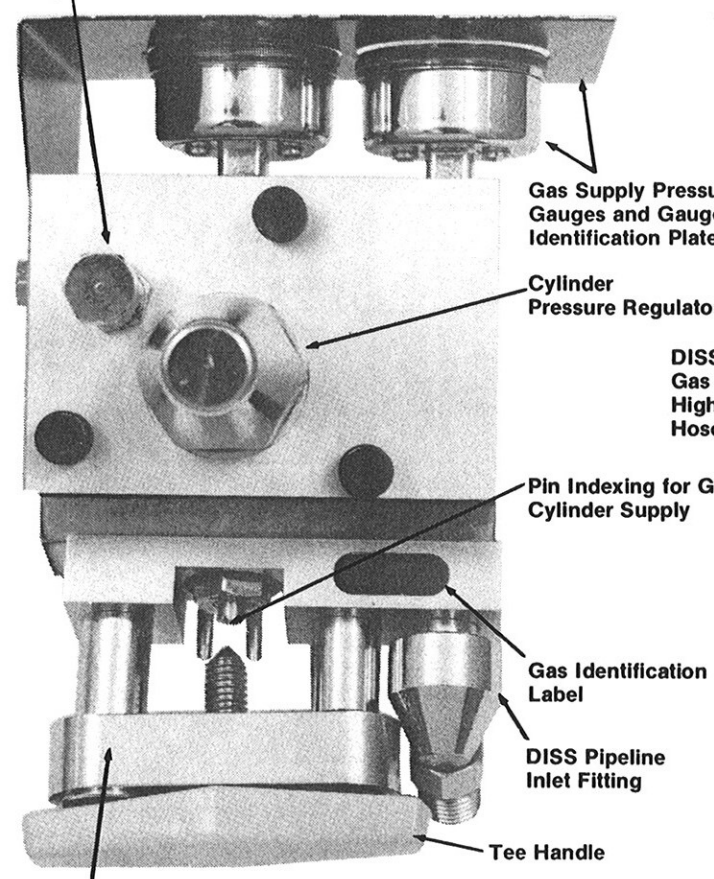


Figure 3A.
Gas Supply Module
Top View

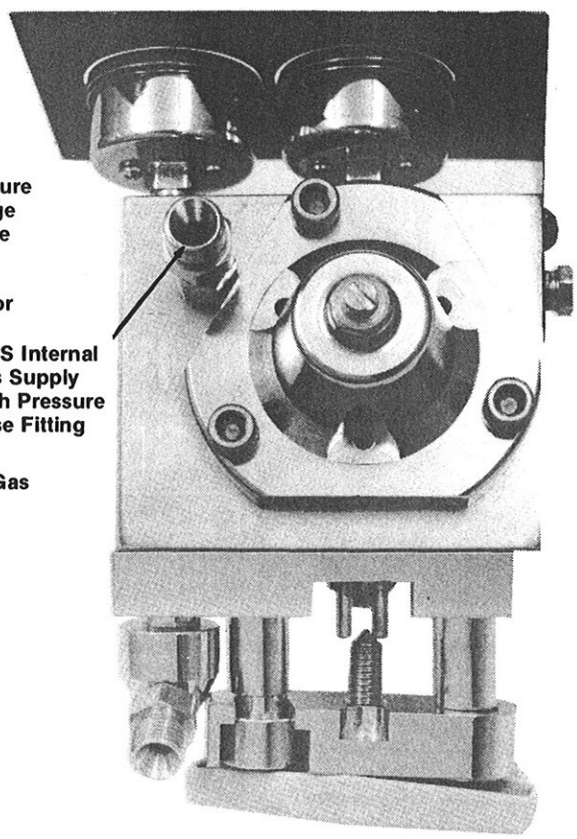


Figure 3B.
Gas Supply Module
Bottom View

2.3 Gas Supply Modules

The block of a Gas Supply Module incorporates a DISS pipeline inlet fitting (except modules for non-pipeline gases), a cylinder hanger yoke, a regulator, and one or two gas supply pressure gauges (see Figures 3A and 3B). Oxygen, Nitrous Oxide, and AIR supply modules each have two gas supply pressure gauges. One gauge indicates pipeline pressure, the other gauge indicates cylinder pressure. Gas Supply Modules for non-pipeline gases have a single gauge to indicate cylinder pressure. All gauges have black on white dual calibration scales. A gauge identification plate is mounted on each Gas Supply Module so that the gauge(s) appears against a background color-coded for and labeled with the gas supplied.

A Gas Supply Module is mounted on the panel at the back of the machine so that the module's pressure gauge(s) and identification plate are viewed in one of the windows at the front of the machine and its regulator is concealed. Pipeline inlet fittings and cylinder hanger yokes extend through the mounting panel (see Figure 4). A maximum of four Gas Supply Modules or a combination of Gas Supply Modules and Add-on cylinder hanger yokes can be mounted on the panel.

There are four cylinder bumpers furnished on all Modulus Anesthesia Gas Machines (see Figure 5). If a machine is equipped with only two or three Gas Supply Modules, the remaining spaces of the four provided in the mounting panel may have Add-on cylinder hanger yokes installed. These Add-on yokes are available for oxygen and nitrous oxide only and allow a single Gas Supply Module to accommodate an additional gas cylinder.

NOTE: Installation of Add-on cylinder yokes must be made in the factory or by an Ohio Medical Products Service Representative.

2/Description

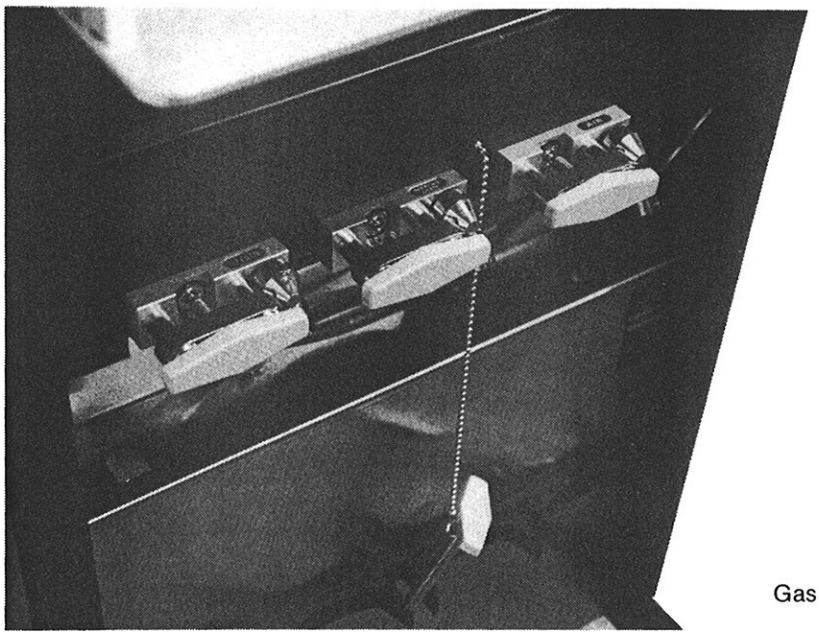


Figure 4.
Gas Supply Module Mounting Panel with Four Modules Mounted

All Gas Supply Module and Add-on yokes are safety pin-indexed. Only cylinders of the gas for which the supply module and Add-on cylinder yokes are designated may be installed. In addition, the pipeline inlets and cylinder gate blocks of each Gas Supply Module are clearly labeled with the name of the gas to be supplied. A captive cylinder tee handle wrench is attached to the mounting panel with a bead chain so that it will always be available when needed.

Cylinder pressure regulators within the Gas Supply Module are adjusted to an outlet pressure of nominal 45 psig (310 kPa) for all gases supplied. A regulator safety relief valve is set at 120 psig (827 kPa).

Pipeline inlets for oxygen, nitrous oxide and AIR allow the machine to be supplied from the hospital pipeline at nominal 50 psig (345 kPa). Pipeline inlet fittings have check valves which minimize loss or back flow of gases. High pressure hoses with DISS fittings connect the hospital gas supply outlets to the Gas Supply Module inlets.

DISS coded high pressure hoses connect the Gas Supply Modules to gas circuitry in the FCM. The DISS fittings reduce the danger of inappropriate interchanging or cross connecting of internal gas supply lines.

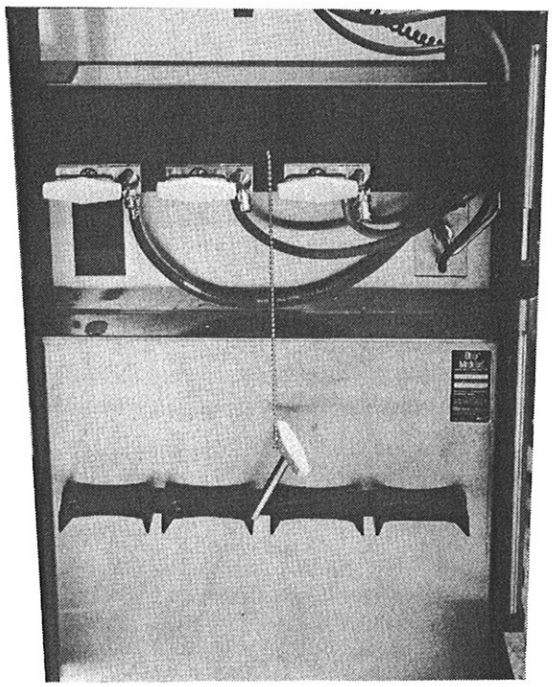


Figure 5.
Lower Rear View of Machine Equipped with Three Gas Supply Modules

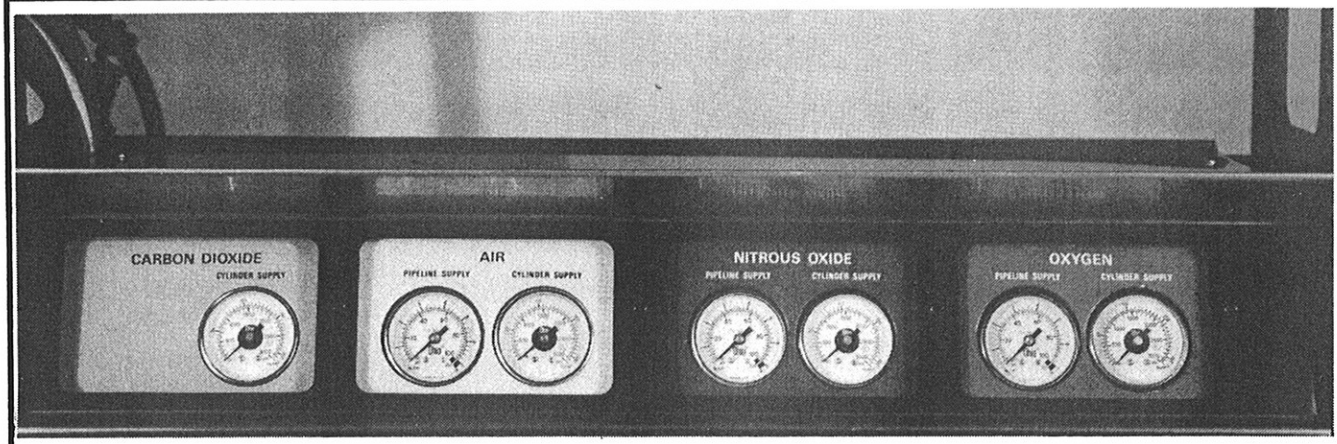
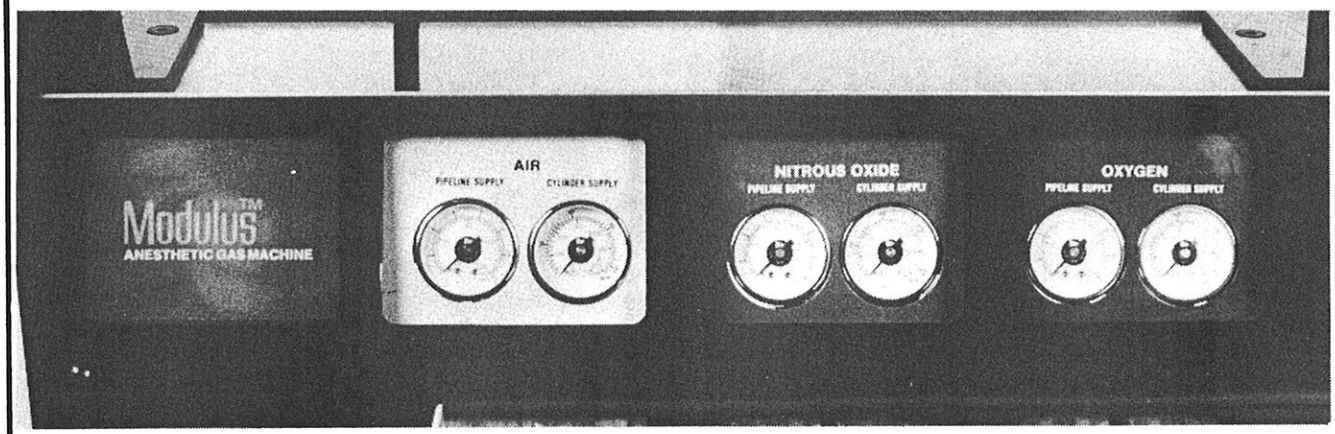


Figure 6A.
Pressure Gauge Window Panel for Four Gas Machine



NOTE: Non-used pressure gauge windows are provided with a blank.

Figure 6B.
Pressure Gauge Window Panel for Three Gas Machine

2.4 Pressure Gauge Window Panel

As previously stated, when a Gas Supply Module is mounted, its gauge(s) and identification plate are viewed in one of the four windows at the front of the machine. Each window shows the gauge or gauges for one Gas Supply Module. If a machine is equipped with fewer than four Gas Supply Modules, its unused windows have a blank plate installed (see Figures 6A and 6B).

When the four window panel is viewed from the front:

1. oxygen gauges are always in the window to the right,
2. nitrous oxide gauges are in the window to the left of the oxygen gauge window,
3. AIR gauges (if equipped) are in the window to the left of the nitrous oxide gauge window, and
4. the gauges for other gases are positioned, as specified, to the left of nitrous oxide (when AIR is not equipped) or AIR.

The right to left sequence of the supply pressure gauges within the window panel, directly corresponds to the right to left sequence of respective flowmeter modules in the Flow Control Module.

A stainless steel tray is mounted above the pressure gauge window panel, and above the tray is an open space so that the operator can reach through from the front of the machine to open or close the cylinder valves located at the back of the machine.

2/Description

2.5 Flow Control Module (FCM)

The Flow Control Module (see Figure 7) or FCM is for the most part, self contained and has optional locations on the machine depending upon the model chosen. The FCM houses a manifold with a gas distributing capability compatible with that of the specified gas supplies. The manifold provides a juncture for gas circuitry components and is pin-indexed to accommodate flowmeter modules: a feature which makes the FCM modular within itself.

The FCM houses the controls and circuitry for the following:

1. the Machine ON-OFF switch
2. the Pressure Sensor Shutoff Valve system and Oxygen Supply Failure Alarm system
3. the second stage pressure regulators
4. the flowmeter modules, flow control valves and the Link-25 Proportion Control Limiting System
5. the Oxygen Flush valve
6. the Power Outlet and
7. the Vaporizer Selector-Interlock Valve system.

As previously stated, high pressure hoses are used to make the connection from the Gas Supply Modules to FCM.

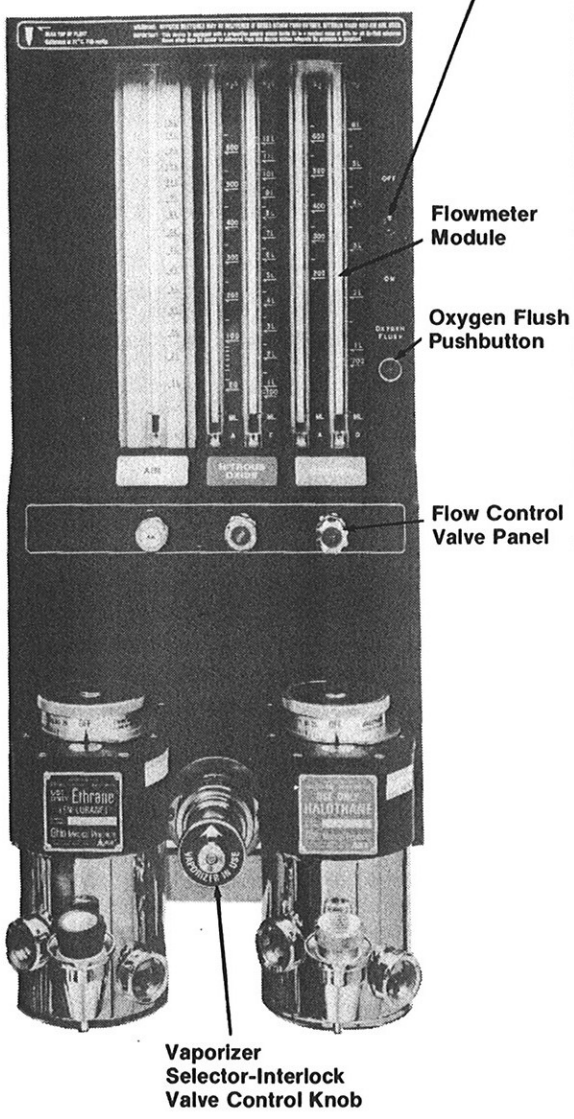


Figure 7.
Flow Control Module for Three Gas Machine

A. Machine ON-OFF Switch

A toggle type pneumatic ON-OFF switch is recessed in the right hand vertical control panel of the FCM. When switched ON, it supplies oxygen to: 1) the second stage oxygen pressure regulator 2) the Pressure Sensor Shutoff Valve system and 3) the Oxygen Supply Failure Alarm system. Oxygen downstream of the Machine ON-OFF switch is vented to the atmosphere when the switch is in the OFF position.

B. The Pressure Sensor Shutoff Valves and Oxygen Supply Failure Alarm

Pressure Sensor Shutoff Valves are diaphragm operated, normally closed valves which shut off all gas flow if the oxygen supply pressure fails (falls to 20 psig [138 kPa]).

The Oxygen Supply Failure Alarm is activated when the oxygen supply pressure drops below 30 psig (207 kPa). Its sound is sustained for a minimum seven seconds when the flow is equal to or less than one third of the flow scale calibration range. The alarm will also activate if the oxygen supply is intentionally shut off.

C. Second Stage Pressure Regulators

Both the oxygen and the nitrous oxide supply lines are equipped with second stage pressure regulators. The second stage regulator for oxygen is set at 12 psig (82.7 kPa) and is located in the line between the Machine ON-OFF switch and the inlet to the gas distribution manifold. Its function is to:

1. continue the preset flow of oxygen so that oxygen will be the last gas flow to decrease and shut off if oxygen supply failure and consequent decrease in oxygen pressure occurs.

2. provide a setting relative to that of the nitrous oxide second stage regulator in order to accommodate the operation of the Link-25 Proportion Limiting Control System, and

3. minimize flowmeter float bobbing when high flows from the Power Outlet cause pressure fluctuations in the nominal 50 psig (345 kPa) pressure supply lines.

The nitrous oxide second stage regulator is factory preset to a accommodate the operation of the oxygen-nitrous oxide Link-25 Proportion Limiting Control System.

D. Flowmeter Modules and Flow Control Valves

Flowmeter modules are safety pin-indexed to be compatible with the indexing of the gas distribution manifold and are designed to be easily removed and replaced. A transparent plastic shield protects the flowmeter modules from damage. Each flow control valve is found directly under the flowmeter module it controls.

Flowmeter modules and their respective flow control valves are positioned so that, when the FCM is viewed from the front:

1. oxygen is always on the extreme right,
2. nitrous oxide is always to the immediate left of oxygen,
3. AIR (if equipped) is always on the immediate left of nitrous oxide, and
4. other gases are positioned, as specified, to the left of nitrous oxide or AIR.

All flowmeter scales and flow control valve knobs are color and symbol coded for the gases they meter. The oxygen flow control valve is touch coded (fluted) for easy non-visual identification. Scales are individually hand calibrated for accuracy. Large plumb-bob shaped floats are easily visible against a white background.

Oxygen and nitrous oxide flowmeter modules may be equipped with a double flowtube. The two flowtubes are connected in series within the module and the gas flow through them is controlled by a single flow control valve.

The Link-25 Proportion Limiting Control System links the flow control valves for oxygen and nitrous oxide. It operates in such a way that the oxygen flow may be increased without affecting the flow of nitrous oxide, and the nitrous oxide flow may be decreased without affecting the flow of oxygen; but that in any oxygen-nitrous oxide mixture there will be at least a nominal 25% oxygen concentration. A stop on the oxygen flow control valve prohibits oxygen from being supplied at less than 200 ml/min.

WARNING: Hypoxic mixtures may be delivered if gases other than oxygen, nitrous oxide, and/or AIR are used.

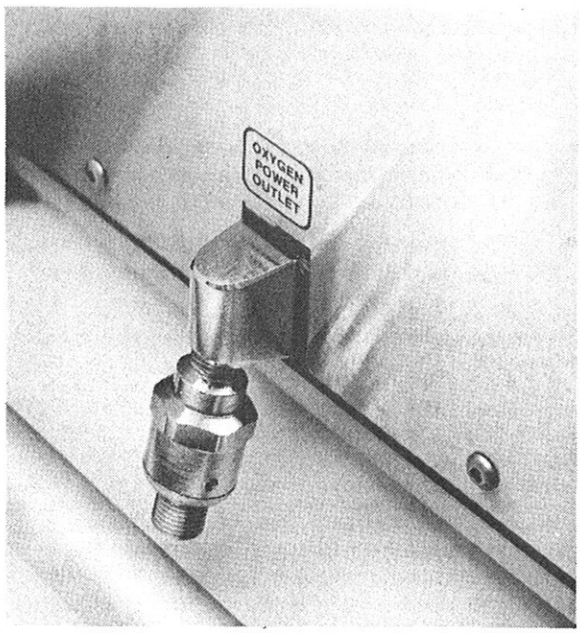


Figure 8.
Power Outlet

E. Power Outlet

A Power Outlet is mounted on the lower back of the FCM and provides a nominal 50 psig (345 kPa) source of power from the Oxygen Supply Module to operate an anesthesia ventilator (see Figure 8). The Power Outlet has a male DISS fitting. A compatible high pressure hose is used to connect the Power Outlet to a ventilator. A one way check valve in the outlet fitting helps eliminate loss of oxygen supply when the Power Outlet is not used.

The Machine ON-OFF switch does not control the oxygen supply to the Power Outlet.

F. Oxygen Flush

The direct flow, self-closing, Oxygen Flush pushbutton is located on the right hand vertical control panel of the FCM and is guarded (recessed) to minimize the chance for accidental engagement. The pushbutton controls a valve which, when open (pushed in), supplies an oxygen flow of not less than 35 LPM and not greater than 75 LPM to the breathing circuit. Like the Power Outlet, the Oxygen Flush operates independent of the Machine ON-OFF switch.

G. Vaporizer Manifold and Vaporizer Selector-Interlock Valve

The Vaporizer Selector-Interlock Valve and mounting manifold are integral components of the FCM, designed to be compatible with the modular nature of the anesthesia machine and to accommodate Ohio calibrated vaporizers.

NOTE: Verni-Trol® Anesthetic Vaporizers and a vaporizer oxygen circuit are available as an option. See Section 2.9.

Two vaporizers may be mounted on the Vaporizer Selector-Interlock Valve manifold.

The Vaporizer Selector-Interlock Valve control knob is located between the two vaporizer mounting locations.

Its three positions allow for the following:
1. gas flowing directly to the common gas outlet
2. gas directed through the vaporizer on the left or
3. gas directed through the vaporizer on the right.

Each of these positions are mutually exclusive, and the Selector-Interlock Valve design minimizes the chance of accidental intermediate positioning. An arrow on the face of the control knob points to the vaporizer through which the gas flow is being directed. Any appropriately equipped Ohio calibrated vaporizer may be mounted on either mounting location, but it is the responsibility of the operator to set the desired concentration of agent in the measured flow, and to open the vaporizer to be used. It should not be possible to open the non-selected vaporizer, nor should it be possible to open any vaporizer with the Selector-Interlock Valve in the BYPASS position.

Two manifold caps are supplied with the machine. If one of the vaporizer mounting locations is not being used, it must have a manifold cap installed (see Section 3.4). When a vaporizer mounting location has a manifold cap installed, and the Selector-Interlock Valve control knob is inadvertently rotated to select that location, the gas flow is directed to the common gas outlet. Gas flow is also directed to the common gas outlet if the Selector-Interlock Valve is inadvertently rotated to select a vaporizer which is OFF.

WARNING: A manifold cap must be installed in the absence of a vaporizer, or all gas flow may be vented to the atmosphere and prevent metered gases from reaching the patient.

When a vaporizer is mounted on each of the two vaporizer mounting locations, they are connected in parallel; that is, there is no common flow line from one vaporizer's outlet to the other vaporizer's inlet. The advantage of parallel connection is that residual vaporized flow from an OFF vaporizer can not carry over to the vaporized flow of an ON vaporizer.

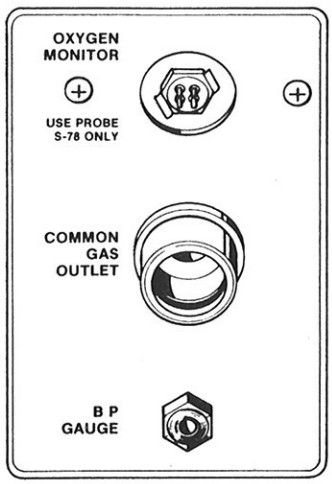


Figure 9.
Machine Outlet Panel

2.6 Machine Outlet Panel

The Machine Outlet Panel is clearly labeled and includes: 1) the common gas outlet 2) the oxygen monitor locking male connector and 3) the blood pressure gauge Luer-Lok connection (see Figure 9). The panel is located in the lower frame below the pressure gauge panel and adjacent to the upper drawer cabinet. Specific location of the Machine Outlet Panel will vary with the model ordered. In-frame connections are made from connectors at the back of the machine (directly behind the panel) to their respective instruments.

NOTE: An outlet line check valve is located between the vaporizers and the common gas outlet. Its purpose is to prevent backflow into the vaporizer, therefore, minimizing the effects of downstream intermittent pressure fluctuations on agent concentration. For example, in the absence of the outlet check valve; pushing then releasing the Oxygen Flush pushbutton could cause a back pressure spontaneously resulting in high concentrations of anesthetic vapor building in the vehicle gas and then being delivered to the patient.

A four pin locking male connector is provided in the Machine Outlet Panel for those models equipped with the Ohio 401 Oxygen Monitor. A concealed extension cable fits from the male connector to the chosen location on the anesthesia machine for the oxygen monitor. If a blood pressure gauge is furnished, the connection is made by attaching appropriate tubing from the nipple at the back of the machine (directly behind the BP Luer-Lok connection) to the chosen location of the BP gauge.

2/Description

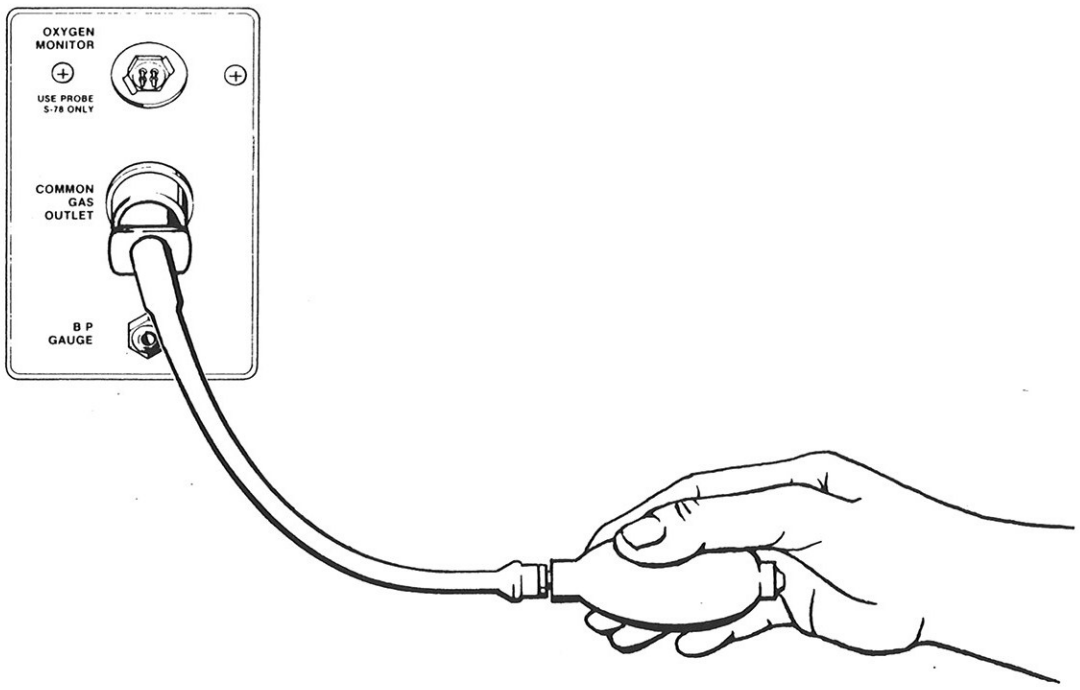


Figure 10.
Connection of Low Pressure Leak Testing Device
Stock No. 0309-1318-800

2.7 Low Pressure Leak Testing Device

WARNING: Leakage of gases and vapors to the atmosphere from gas circuits of the anesthesia machine (downstream of the flow control valves and oxygen flush valve) may deprive the patient of metabolic gases and anesthetic agent, and may pollute the atmosphere. Tests which detect such leakage must be performed frequently. If detected, leakage must be reduced to an acceptable level. It is recommended that the Low Pressure Leak Testing Device be kept with the anesthesia machine at all times.

A Low Pressure Leak Testing Device (see Figure 10) is supplied with the Modulus Anesthesia Gas Machine. This device is to be used after initial setup of the machine and thereafter at frequent intervals as described in the Preoperative Checklist test procedures provided in Section 4.9.

The testing device has a rubber squeeze bulb with an exhaust check valve in one end, and an inlet check valve in the other end. A flexible rubber tube connects the inlet check valve to a 6mm male x 15mm diameter male tubing connector.

2.8 Additional Modulus Anesthesia Gas Machine Standard Equipment

All Modulus Anesthesia Gas Machines are equipped with the following:

1. a stainless steel shelf which may be used for instruments or monitoring equipment,
2. a push bar mounted at the back of the machine, and
3. an absorber mounting post with a pushbutton, adjustable, elevating swivel arm assembly. The Ohio Model 21 Absorber, specially modified for Modulus Anesthesia Gas Machines, mounts on the assembly.

Dimensions and locations of the above mentioned items may vary depending upon the model ordered.

2/Description

2.9 Optional Equipment

NOTE: For more information on the optional equipment discussed in this section, call an Ohio Medical Products Sales Representative.

A. Absorber

The optional Ohio Model 21 Absorber is equipped with a special crossbar which is compatible with the Modulus Anesthesia Gas Machine mounting assembly. A separate OM manual is provided with the absorber. Information about the absorber, specific to its use with the Modulus Anesthesia Gas Machine, is found in Section 3.5 of this manual.

B. Vaporizers

Ohio Calibrated Vaporizers must be ordered for specific use on the Modulus Anesthesia Gas Machine. An L-shaped mounting bracket is installed on the back of such vaporizers.

NOTE: An Ohio Calibrated Vaporizer already having a flanged Interlock style control knob, but lacking the L-shaped bracket, must be retrofitted for Modulus Anesthesia Gas Machine use. A kit (Stock No. 0216-6744-870), which may be customer installed, is available for this purpose.

If an Ohio Calibrated Vaporizer has no Interlock Style control knob, and Modulus Anesthesia Gas Machine use is desired, the vaporizer must be sent to the National Service Center for complete retrofitting service. Whenever an Ohio Calibrated Vaporizer control knob is replaced, for any reason, recalibration is essential. Only the National Service Center (address is on the back cover of this manual) may perform recalibration.

Verni-Trol® Anesthetic Vaporizers may be used on models ordered with the complete Verni-Trol Anesthetic Vaporizer option. Such machines have an additional oxygen circuit for operating a Verni-Trol Vaporizer. The vaporizer oxygen circuit includes a flowmeter module and flow control valve. For information regarding field modification of earlier Modulus Anesthesia Gas Machines call an Ohio Medical Products Service Representative.

Information about vaporizer installation and operation of the Vaporizer Selector-Interlock Valve can be found in Sections 3.4 and 4.5 of this manual; however, additional operation and maintenance information is found in the separate OM manual provided with each vaporizer.

C. Ventilators

The Ohio V5 Controller Ventilator, the Ohio Fluidic Ventilator, or the Ohio Fluidic Pediatric Ventilator can be mounted on a Modulus Anesthesia Gas Machine. The location and type of mount used for a ventilator vary with the Modulus Anesthesia Gas Machine model ordered.

A separate OM manual is provided with each ventilator. Information about ventilators specific to their use with the Modulus Anesthesia Gas Machine is found in Sections 3.6 and 3.7 of this manual.

D. Waste Gas Scavenging Interface Valve

The Waste Gas Scavenging Interface Valve (see Figure 16) provides a common conduit and control manifold for channeling waste gas from the anesthesia circuit (from the absorber or ventilator gas evacuation outlets) to an available waste gas disposal system. The location of the valve varies, but it is usually located on the absorber support crossbar.

The Waste Gas Scavenging Interface Valve manifold includes: 1) four 19mm nipples for tubing and reservoir bag connections, 2) a needle valve which controls the flow to a small bore vacuum hose nipple and 3) a pair of relief valves for limiting positive or negative pressure which may develop within the system (positive set at a nominal 1.4 cm H_2O, negative set at a nominal 0.6 cm H_2O).

The specific method chosen for using the Waste Gas Scavenging Interface Valve will depend upon the operator's choice of anesthesia circuit and the type of hospital waste gas disposal system available (see Section 3.8A and B).

E. Bain Circuit Adapter and Mounting Bracket

A mounting bracket is available for adapting a Bain circuit manifold to the Modulus Anesthesia Gas Machine. The Bain circuit is a disposable partial rebreathing type anesthesia circuit.

2/Description

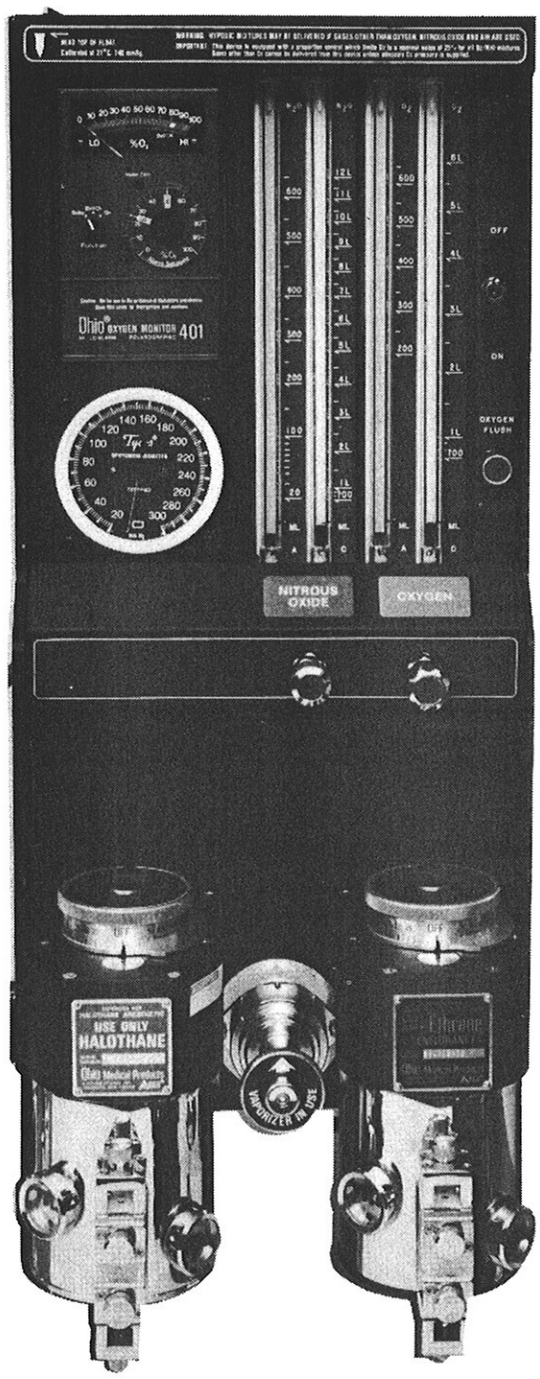


Figure 11.
Instrument Panel Mounted in FCM
(Two Gas Machine Only)

F. Blood Pressure Gauge and Oxygen Monitor

The Tycos* Blood Pressure Gauge and Ohio 401 Oxygen Monitor, if ordered, are installed on the Modulus Anesthesia Gas Machine. One or both instruments are mounted either in an instrument panel located in the FCM or in a monitor pod mounted under the lowest shelf of a monitor rack. Instrument panels can be installed in FCMs for two-gas machines only. Installation of a monitor pod requires the presence of a monitor rack. See Figures 1 and 11. As previously stated in-frame extensions are provided which appropriately connect the instruments to the Machine Outlet Panel.

Separate OM manuals are provided with each unit, but information specific to the Modulus Anesthesia Gas Machine can be found in Section 3.11 of this manual.

G. Side-Kick® Blood Pressure Cuff Inflator

The "Side-Kick" cuff inflator, when properly adjusted and triggered, inflates and deflates the blood pressure cuff and then readies itself for another cycle. The cycle is initiated by brief pressure on the knob of the inflator positioned near the foot rest of the anesthesia machine. The knob can be pushed with the operator's foot. A separate OM Manual is provided with each unit.

H. Add-On Drawer Cabinet

The optional Add-on drawer cabinet, if ordered, is attached under the standard drawer cabinet and provides an additional 16 vertical inches of drawer space which may be equipped with:

1. two 8" (20.3cm) high drawers
2. two 4" (10.1cm) high drawers and an 8" (20.3cm) high drawer or
3. four 4" (10.1cm) high drawers.

A drawer lock is not available for the Add-on drawer cabinet.

I. Monitor Rack

Additional space for placing monitoring equipment can be provided with an optional one or two shelf monitor rack. These racks fit above the standard monitor shelf. As previously stated, a O_2/BP Monitor Pod may be furnished with the optional monitor rack. Shelf legs are adjustable in one inch increments from a height of 7¾ inches to 11¾ inches (19.7cm to 29.8cm). All monitor rack shelves are provided with two Velcro straps for securing monitoring equipment.

* Trademark of Taylor Instruments

3/Set Up

3.1 General

The Modulus Anesthesia Gas Machine is shipped with the Flow Control Module detached from the stand. Most optional equipment is preinstalled with the exceptions of the absorber, the ventilator, the O_2/BP Monitor Pod and the vaporizers. Other than procedures outlined in this section, assembly of the Modulus Anesthesia Gas Machine and Ohio accessories must be completed by an Ohio Medical Products Representative. All equipment must be immediately checked for damage. If damage is found, notify the transportation company and fill out the appropriate claim forms.

This section describes basic user-performed setups of the Modulus Anesthesia Gas Machine or accessories. After setup for use, it is recommended that several preoperative checkout test procedures be performed daily to verify the operative integrity of the machine.

A plastic "Preoperative Checklist" card is located under the upper drawer cabinet. Slide the checklist out from under the drawer cabinet when it is to be consulted and slide it back when the checkout test procedures have been completed. The card provides **only the list** of check-out test procedures to be performed. Detailed instructions for performing the test procedures are provided in Section 4.9 of this manual.

3.2 Cylinder Installation

1. Use "D" or "E" size gas cylinders.

2. Push the hanger yoke gate tee handle toward the yoke body and pull up on the tee handle so that the gate swings open counterclockwise. Back out the tee handle until the tip of the screw is flush with the inside surface of the gate.

3. Before installing a cylinder in the hanger yoke, make sure the cylinder valve dust cap (if present) is removed. Then crack the valve (open then immediately close) to blow any foreign matter out of the valve outlet.

4. If there is an old gasket on the strainer nipple of the yoke, it should be removed and replaced with a fresh gasket each time the cylinder is replaced.

CAUTION: Use only one cylinder gasket per yoke. Inadvertent use of more than one gasket could cause leakage of the cylinder gas.

5. Install the cylinder valve over the strainer nipple, making sure the safety index pins are engaged. Close the gate and turn the tee handle (by hand only) to hold the cylinder firmly in place. The gate will lock against accidental opening when the tee handle is tightened.

When two cylinders are providing a gas supply, a check valve permits replacement of a depleted cylinder while the other remains in use. Always use yoke plugs to seal an unused yoke.

CAUTION: Yoke check valves may not provide a leak free seal: Always use yoke plugs to seal an unused yoke.

Leave all cylinder valves closed until the Pre-operative checkout test procedures have been performed.

3.3 Pipeline Inlet Connections

Verify that the Machine ON-OFF switch is in the OFF position. Attach appropriate high pressure DISS fitting hoses from the hospital pipeline outlets to the machine inlets.

3.4 Mounting Vaporizers

To mount a vaporizer equipped for use on the Modulus Anesthesia Gas Machine do the following:

1. Make sure the vaporizer control knob is turned OFF.

2. Rotate the Selector-Interlock Valve control knob to select the vaporizer mounting location upon which the vaporizer is to be mounted (left or right).

3. Back out the thumb screw from the rear of the vaporizer mounting location.

4. Hold the vaporizer firmly with both hands and tilt it slightly so the two holes in the vaporizer mounting bracket fit over the pair of locating pins of top of the vaporizer mounting location (see Figure 12A).

WARNING: Do not tilt any vaporizer more than 45 degrees while it contains liquid anesthetic agent. Use of the vaporizer after such tilting may cause dangerously high concentrations of anesthetic agent to be delivered to the patient. Consult the appropriate vaporizer OM manual for details on this and other precautions regarding the use of a vaporizer.

5. Gently lower then release the vaporizer so that it hangs from the locating pins. The weight of the vaporizer will help seal the inlet and outlet ports.

6. Tighten the thumbscrew so that the vaporizer is secured. While tightening the thumbscrew slightly push the vaporizer against the manifold to assist sealing (See Figure 12B).

7. Return the Selector-Interlock Valve control knob to the BYPASS position.

If one of the two vaporizer locations is not to be used, a manifold cap must be installed. This is done by plac-

Figure 12A.
Mounting Vaporizer

Figure 12B.
Mounting Vaporizer

ing the locating nipples of the manifold cap into the inlet and outlet ports of the vaporizer manifold locations and tightening the thumbscrew into the manifold cap body (see Figure 13).

WARNING: A manifold cap must be installed in the absence of a vaporizer, or all gas flow may be vented to the atmosphere and prevent metered gases from reaching the patient.

3.5 Mounting Absorber

The Model 21 Absorber must be ordered or retrofitted to fit on the Modulus Anesthesia Gas Machine. Figure 14 shows a mounted absorber. If the absorber has not already been mounted on the machine's swivel arm assembly, it may be accomplished as follows (see Figure 15):

1. Use a hex wrench to loosen the ¼" socket set screw in the knurled knob at the bottom of the absorber and disassemble parts as shown in Figure 15.

2. Place the short post assembly, which extends from the bottom of the absorber crossbar, through the hole in the swivel arm assembly. Make certain that it rests securely. Two threaded sections will extend below the swivel arm. The threads with the large diameter are those of the short post; the threads with the small diameter are those of the bail screw.

Figure 13.
Vaporizer Mounting Manifold with One Vaporizer and One Manifold Cap Installed

3/Set Up

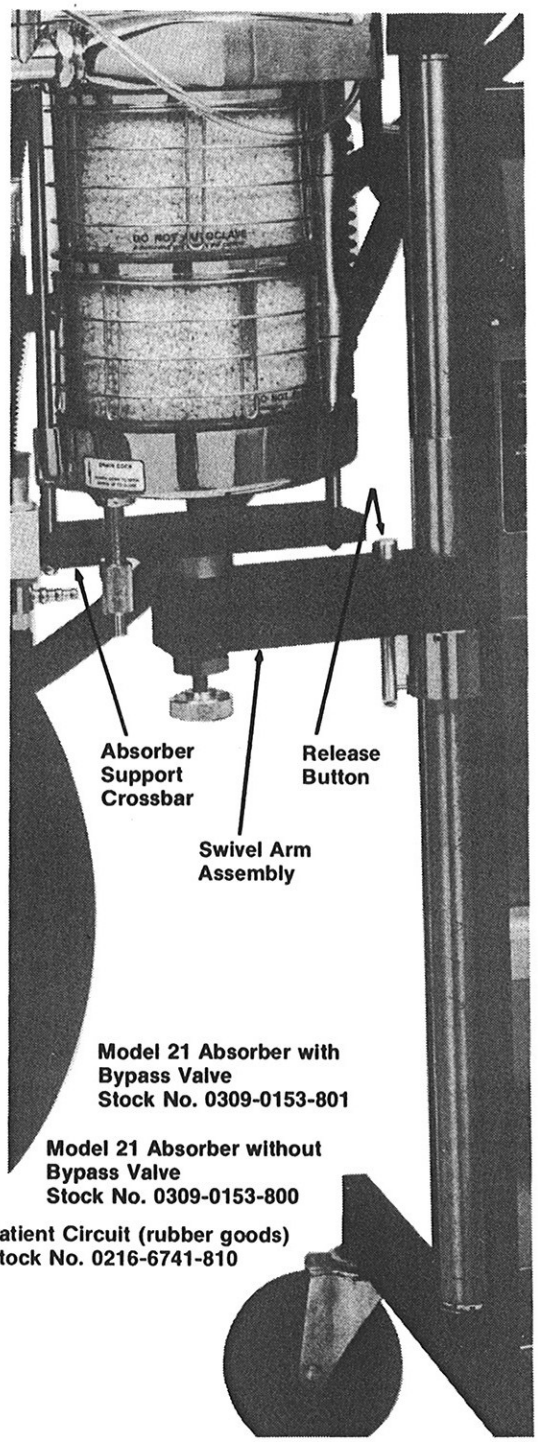


Figure 14.
Modulus Anesthesia Gas Machine Absorber Mount

3. Hold the absorber steady while fitting the provided hex nut onto the large diameter threaded section of the short post extending below the swivel arm. Make sure the hex nut is securely tightened.

4. Thread the knurled knob onto the bail screw until the bail screw is flush with the bottom surface of the knurled knob. Back off the knurled knob until the set screw is aligned with the flat surface.

5. Tighten the set screw on the flat surface only. Tightening on the threads will result in damage to the threads and consequent difficulty with assembly and disassembly of the absorber mount.

6. Adjust the absorber height by supporting the absorber with one hand, depressing the button in the swivel arm, sliding the absorber to the desired position, and releasing the button. Do not release support of the absorber until certain the position is locked.

7. Turn the knurled knob to seal the canisters in the absorber.

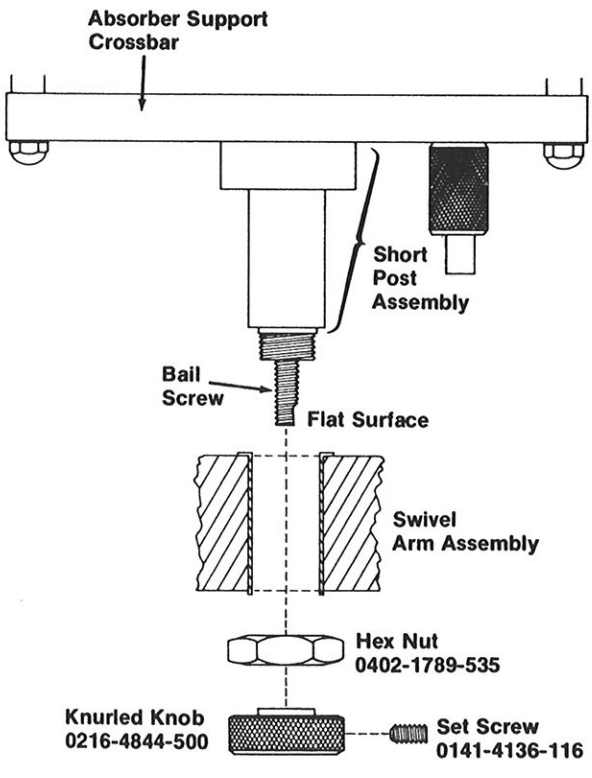


Figure 15.
Exploded View Absorber Mount

3/Set Up

3.6 Mounting Ventilator (Ohio Models)

There are several types of ventilator mounting kits available. The kit used is determined by the machine model on which the ventilator is to be mounted, and the desired ventilator location on the specific model.

Figure 1 shows a left hand bracket mount. This type of mount may also be placed on the right side of the FCM. Installation instructions are provided with each ventilator mounting kit.

3.7 Power Outlet Connection

Connect an appropriate high pressure hose from the Power Outlet to the anesthesia ventilator (if so equipped). NOTE: It is not recommended that cylinder oxygen supply the Power Outlet for a sustained period of time due to the high consumption of gas required to operate a ventilator.

3.8 Waste Gas Scavenging Interface Valve Setup

The Waste Gas Scavenging Interface Valve is most commonly mounted on the slanted side of the absorber support crossbar. Installation instructions are included with the Basic Gas Scavenging System kit for Modulus Anesthesia Gas Machines (Stock No. 0216-6739-870).

Lengths of 19 mm nominal corrugated tubing and a 19 mm nominal bore 3 liter disposable reservoir bag are provided with the Basic Gas Scavenging system kit. These are to be used to make the interface connections. NOTE: Adaptation may be required to make existing accessory fittings compatible with the 19 mm nominal sizes. Contact your Ohio Service Representative for appropriate recommendations for adaptation. The 19 mm nominal tubings and the reservoir bag are marked with yellow bands to indicate their size and use.

A. Setup for Use with a High Vacuum Disposal System

(see Figure 16)

1. Connect a suitable length of tubing from the gas evacuator/relief valve on the absorber to one of the intake manifold ports extending from the top of the interface valve.

2. Connect another suitable length of tubing from the gas evacuation outlet on the anesthesia ventilator to the other port of the intake manifold.

3. Connect the designated 3 liter reservoir bag to a lower 19 mm nipple of the interface valve. Make sure the non-used lower nipple is capped.

4. Connect a small bore vacuum hose from the swivel nipple on the needle valve to a vacuum pipeline system (at least 10 inches Hg [254 mm Hg] required). See Section 4.7 for needle valve vacuum adjustment instructions.

B. Setup for use with a Passive Disposal System

Follow steps 1 and 2 of the setup for use with a high vacuum disposal system. Then do the following:

1. Attach a suitable length of tubing from a lower nipple of the interface valve to the ventilation system. Make sure all non-used nipples are capped.

2. Close the vacuum adjustment needle valve.

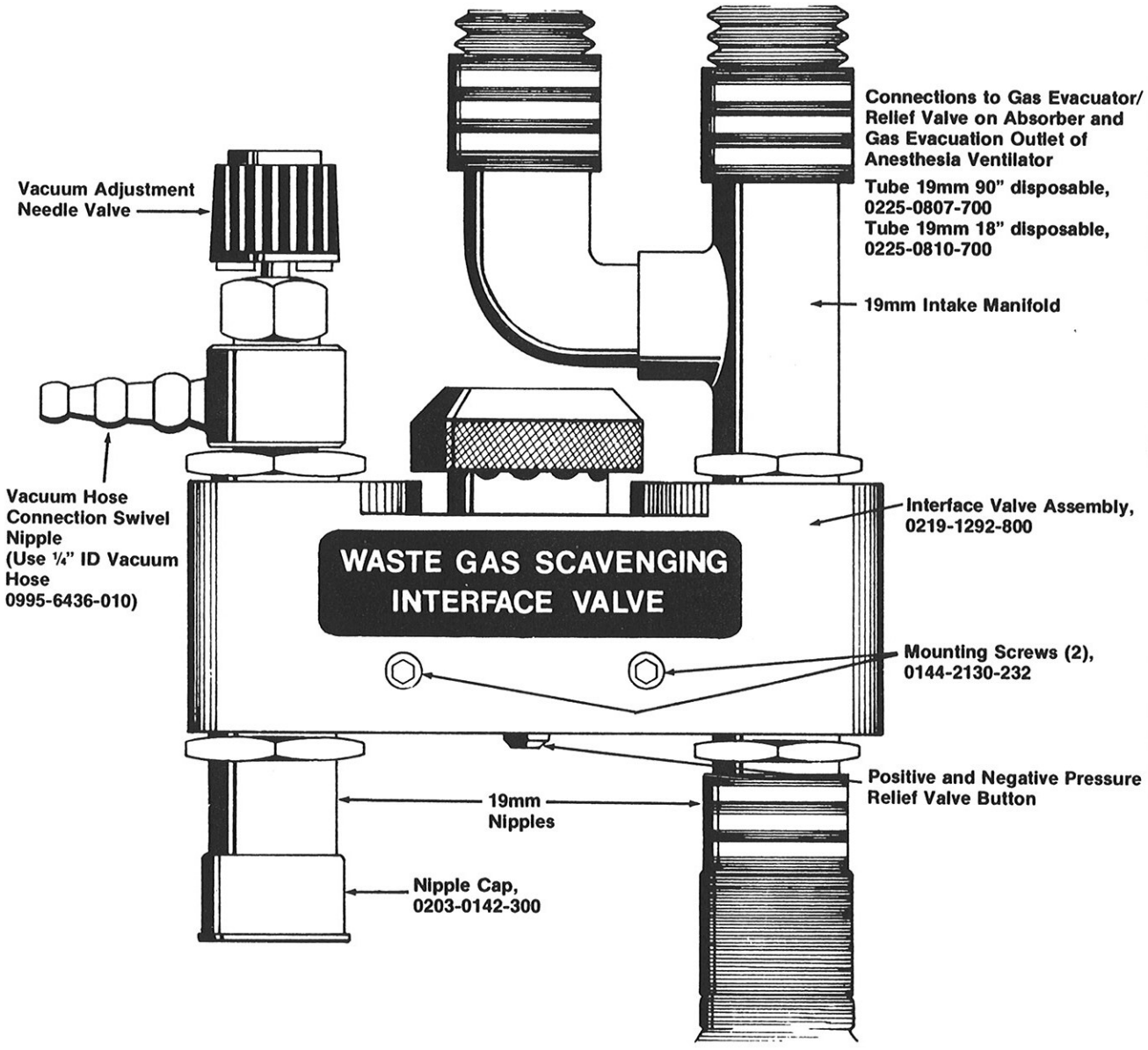


Figure 16.
Waste Gas Scavenging Interface Valve
(included in Basic Gas Evacuation System Kit, Stock No. 0216-6739-870)

3/Set Up

3.9 Patient Circuit Connections

Connect the supply tubing from the machine's common gas outlet to the absorber's inlet using appropriate adapters. Connect the corrugated breathing tubes, the inhaler Y connection, the mask elbow, the appropriate patient mask or tracheal tube, the rebreathing bag and the ventilator (if so equipped).

NOTE: The transparent dome covering the absorber inhalation check valve may be replaced with a dome incorporating a receptacle for an oxygen monitor sensor probe. To order the replacement dome appropriate for the oxygen monitor used, call an Ohio Medical Products Sales Representative.

3.10 Monitor Rack Adjustment

The monitor rack shelves can be adjusted as follows (see Figure 17):

1. Loosen the ⅛" socket set screws at the bottom of each leg.

2. Push each leg forward until it unlocks from its incremental position (a pin holds the leg in position on the grooved increments of the post).

3. Readjust each leg to the desired height and retighten the socket set screws. Make sure the locating pins are firmly engaged with the grooves, that the height of each leg is equal, and that the set screws are firmly tightened.

CAUTION: Do not exceed the height adjustment or weight maximums specified in the installations provided with each monitor rack.

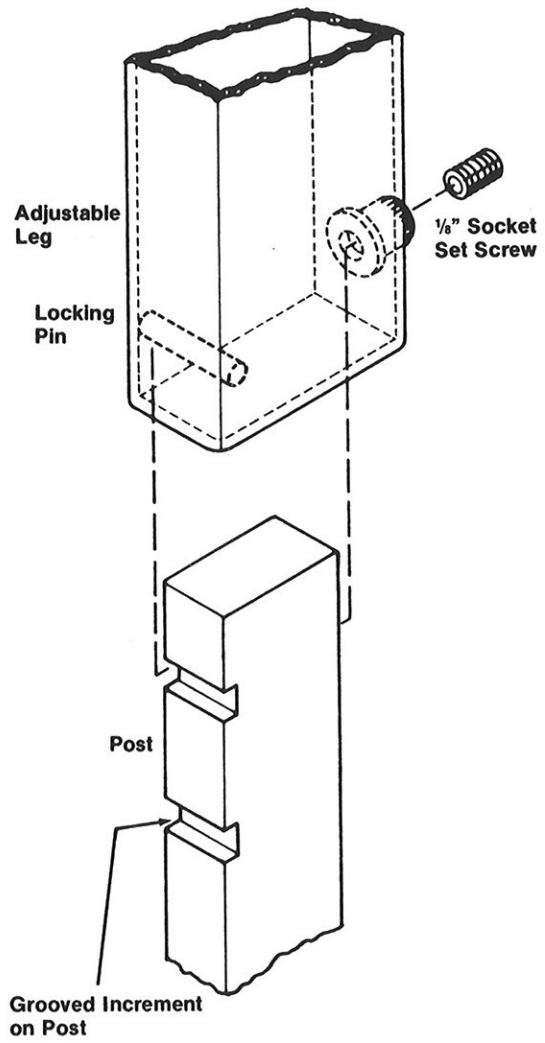


Figure 17.
Monitor Rack Shelf Leg Height Adjustment

3.11 Oxygen Monitor and Blood Pressure Gauge Connections

If an oxygen monitor is furnished, the sensor probe connection is made at the mating four pin male connector on the Machine Outlet Panel. Consult the appropriate oxygen monitor OM manual for further information on setup.

The Luer-lok cuff inflation connection for a blood pressure gauge is also made at the Machine Outlet Panel.

4/Operation

CAUTION: Do not begin daily use of the Modulus Anesthesia Gas Machine until the Preoperative Checklist has been reviewed and all relevant checkout test procedures have been performed.

4.1 Gas Flow

NOTE: The components of the Modulus Anesthesia Gas Machine have been described in Section 2. This discussion, for the most part, will be confined to the gas flow pattern within the anesthesia machine. Refer again to the schematic representations shown in Figures 18 and 19.

All pipeline gas supplies flow from the Gas Supply Modules at nominal 50 psig (345 kPa). All cylinder supplies are regulated within the Gas Supply Module to a nominal 45 psig (310 kPa). A Ventilator requires a supply pressure of 35 psig to 70 psig (241 kPa to 483 kPa) at 30 LPM load for proper operation.

NOTE: It is not recommended that cylinder oxygen supply the Power Outlet for a sustained period of time due to its lower supply pressure and to the high consumption of gas required to operate a ventilator. It is recommended that a switch-over to the anesthesia bag be made whenever a machine is operating from a cylinder supply of oxygen.

Oxygen is supplied from the Oxygen Supply Module to:

1. the Power Outlet
2. the Oxygen Flush valve, which allows a high volume flow directly to the common gas outlet, and
3. the Machine ON-OFF switch.

The Machine ON-OFF switch, when turned ON, opens the oxygen supply line to:

1. the Pressure Sensor Shutoff Valve system
2. the Oxygen Supply Failure Alarm System and
3. the oxygen second stage pressure regulator (set at 12 psig [82.7 kPa]).

When turned OFF, oxygen downstream of the switch is vented to atmosphere (the check valve in the vent is provided to sustain the integrity of the low pressure leak test). The Power Outlet and the Oxygen Flush valve can operate whether the switch is ON or OFF.

The gas line between the nitrous oxide Gas Supply Module and the Pressure Sensor Shutoff valve for nitrous oxide is also equipped with a second stage regulator. This regulator is factory set to accommodate the operation of the Link-25 Proportion Limiting Control System.

The Pressure Sensor Shutoff Valves are oxygen pressure dependent. Each gas supply line is equipped with one such valve in the line between the Gas Supply Module and the gas distribution manifold. In the event of an oxygen supply failure the system of Pressure Sensor Shutoff valves will shut off all gas flow to the distribution manifold when oxygen pressure falls to 20 psig (138 kPa). Also, the Oxygen Supply Failure Alarm system will activate if oxygen pressure falls below nominal 30 psig (207 kPa). Since the Machine ON-OFF switch controls the oxygen supply to the Pressure Sensor System and the alarm system, switching to the OFF position will activate both systems. Whether as a result of actual oxygen supply failure or intentional shut off, oxygen should always be the last gas to stop flowing.

Gases from the Gas Supply Modules enter the gas distribution manifold. There the flow control valves, when open, permit flow to the inlets of the flowmeter modules. Gases are then metered and flow through the flowmeter module outlets into the common mixing passage of the gas distribution manifold.

The mixture of gases then flows to the Vaporizer Selector-Interlock Valve mounting manifold and, depending upon the position of the Selector-Interlock Valve control knob, is directed:
1. to the machine common gas outlet (BYPASS position) or
2. through a selected vaporizer location, back into the Selector-Interlock Valve, and to the machine common gas outlet.

If a manifold cap or an OFF vaporizer is in a vaporizer location which is inadvertently selected, gas is directed immediately back into the Selector-Interlock Valve and to the common gas outlet.

NOTE: Newer model Modulus Anesthesia Gas Machines not ordered with the complete Verni-Trol Vaporizer option, do have a partial circuit installed. As the schematic representations show, this partial circuit has two check valves and interfaces with both vaporizer mounting locations. The circuit is dead-ended at a tee connection behind the vaporizer mounting locations, and is in no way functional without the addition of the complete Verni-Trol Anesthetic Vaporizer option.

A relief valve set at nominal 130 mm Hg is provided in the line between the gas distribution manifold and the vaporizer mounting manifold. In the event of an occlusion downstream of the relief valve, the machine circuitry will be protected against excess pressure build-up.

The outlet check valve provided in the machine common outlet line minimizes back flow from the breathing circuit into the anesthesia machine.

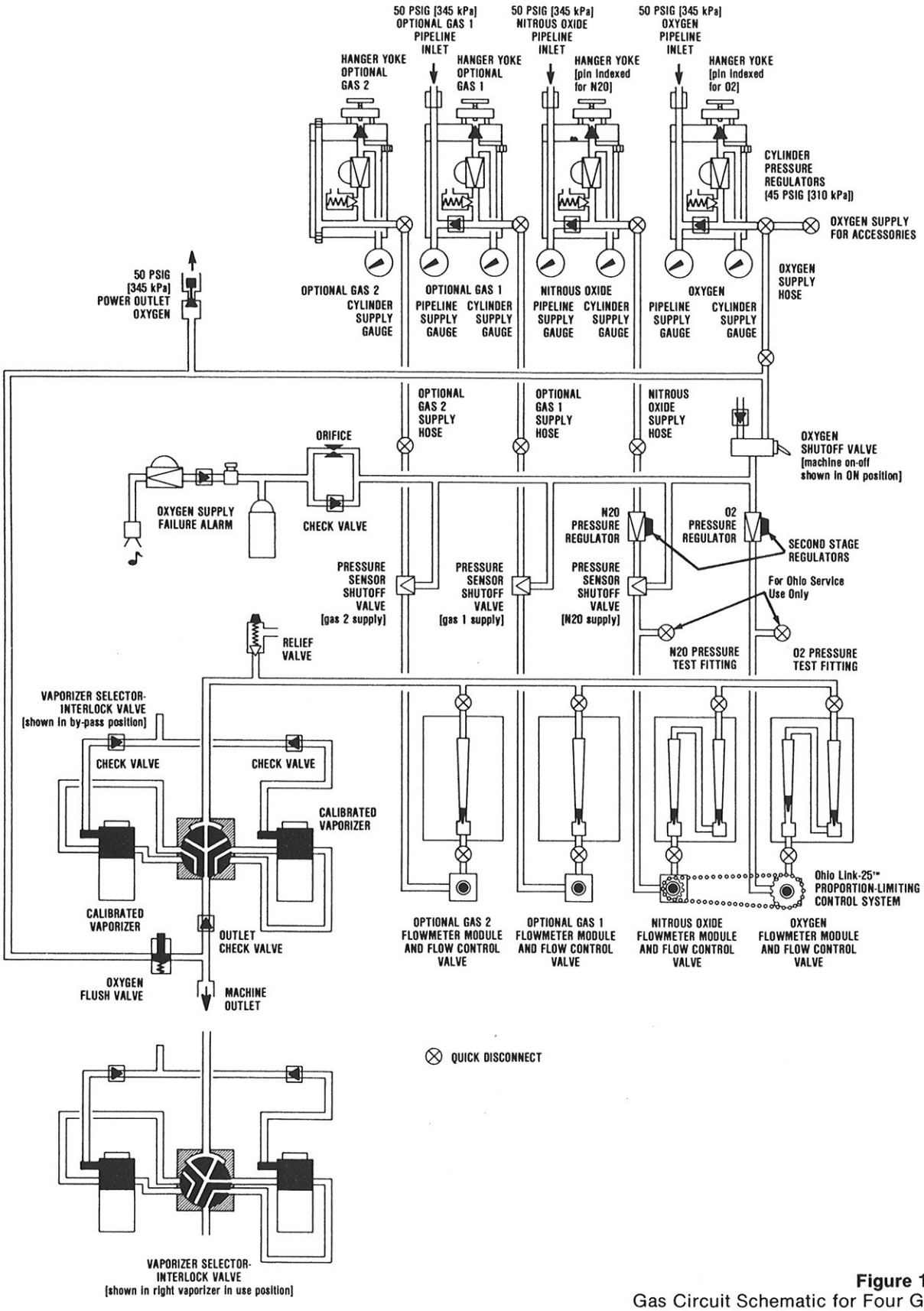


Figure 18.
Gas Circuit Schematic for Four Gas Modulus Anesthesia Gas Machine

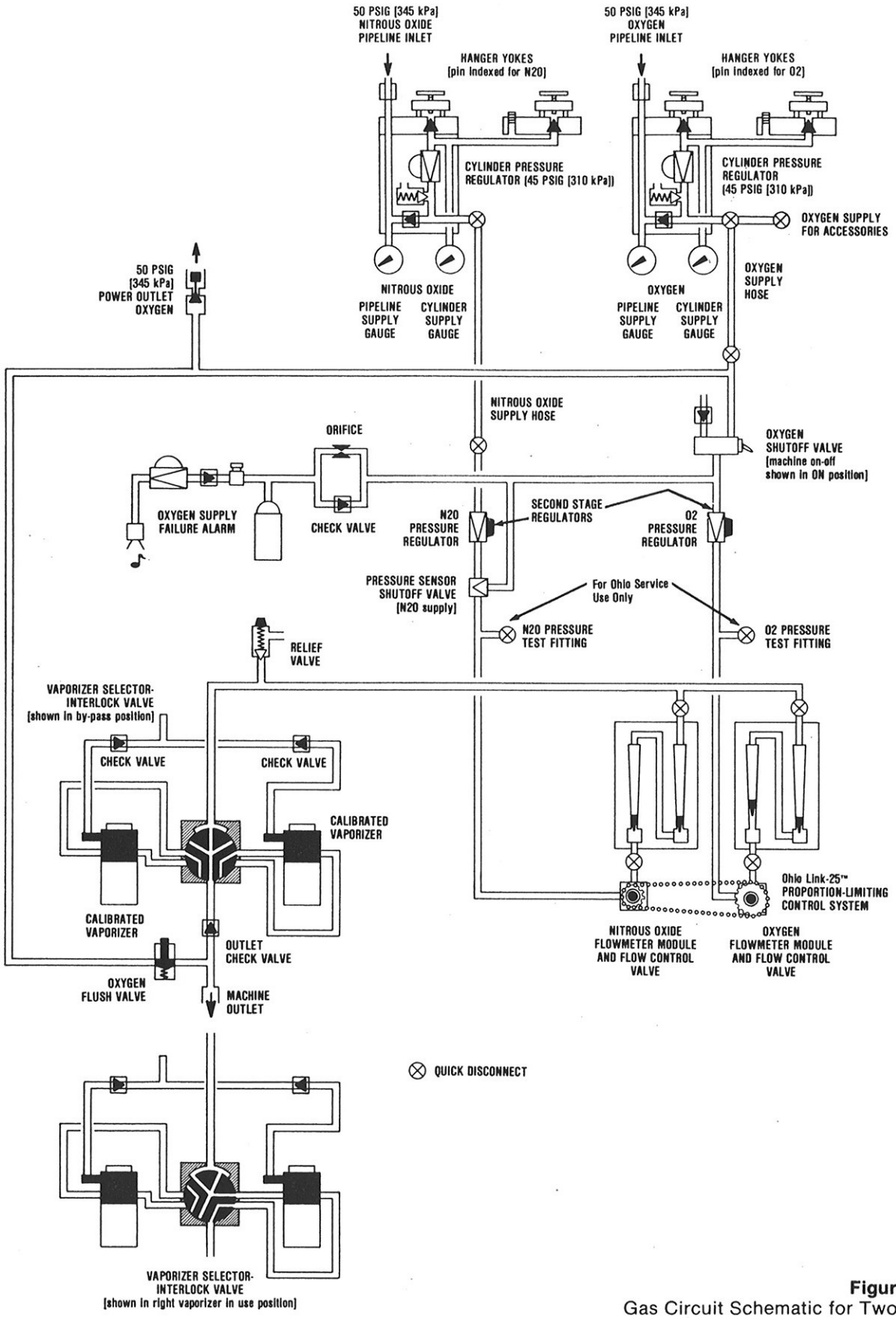


Figure 19.
Gas Circuit Schematic for Two Gas Modulus Anesthesia Gas Machine

4/Operation

4.2 Machine ON-OFF Switch Operation

The function of the Machine ON-OFF switch has already been described in Section 2. The following precautions must be taken when operating this control:

WARNING: Do not leave oxygen cylinders open when the pipeline supply is in use and the Machine ON-OFF switch is in the ON position. Pressures from both oxygen supplies may become equal, and if simultaneously used, cylinder supplies could be depleted, leaving no reserve supply in case of pipeline failure.

WARNING: The oxygen flow control valve is preset to allow a minimum flow of 200 ml/min. To prevent depletion or waste of the oxygen supply always remember to place the Machine ON-OFF switch in the OFF position when the machine is not in use.

CAUTION: Make sure that all flow control valves are turned fully clockwise to their stops before the Machine ON-OFF switch is placed in the ON position. No gases will flow before sufficient oxygen pressure is provided. If the flow control valves of any gases are not turned to their stops, the flowmeter module may be damaged by the sudden onset of flow when the Machine ON-OFF switch is placed in the ON position.

4.3 Link-25 Proportion Limiting Control System Operation

The function of the Link-25 Proportion Limiting Control System has already been described in Section 2. In addition, it should be noted that any flow in which the ratio of oxygen-nitrous oxide is 25/75 the following will happen:

1. increasing the nitrous oxide flow will increase the oxygen flow,
2. decreasing the oxygen flow will decrease the nitrous oxide flow.

Increasing or decreasing one gas by use of the flow control valve of the other gas is not recommended unless the system is being tested. Such use puts an unnecessary strain on the limiting device. It is recommended that when both gas flows are to be increased, oxygen should be increased first; when both flows are to be decreased, nitrous oxide should be decreased first. Oxygen flow will, nonetheless, never be less than nominal 25% of the total oxygen-nitrous oxide flow.

WARNING: The Link-25 Proportion Limiting Control System ensures that only oxygen-nitrous oxide mixtures will have at least a nominal 25% oxygen concentration. HYPOXIC MIXTURES MAY BE DELIVERED IF GASES OTHER THAN OXYGEN, NITROUS OXIDE, AND/OR AIR ARE USED. Also, see page 8 of the OM manual for the complete Verni-Trol Anesthetic Vaporizer option (0178-1701-000) if the machine has this equipment.

4.4 Reading Series-Connected Flow Tube Scales

If oxygen and nitrous oxide are equipped with a double flowmeter module the measured flows will be controlled by the single oxygen or nitrous oxide flow control valve. Gas is first delivered through a flow tube with a low range scale and then through a flow tube with a high-range scale. The floats in both tubes may be operating simultaneously, but the flow rate should be read on the float which lies within the range of a calibrated scale. The scale should be read at the top flat surface of the float. Remember that the oxygen flow control valve is preset for a minimum flow of 200 ml/min.

4.5 Vaporizer Selector-Interlock Valve Operation

To operate the Vaporizer Selector-Interlock Valve pull the knurled control knob forward and turn it so that the imprinted VAPORIZER IN USE arrow points in the direction of the desired vaporizer mounting location. Release the knob and make certain that it locks in the desired position. Positions are as follows (see Figure 20):

1. LEFT VAPORIZER: when in this position the arrow on the control knob points to the left.

2. BYPASS: when in this position the arrow on the control knob points straight up and

3. RIGHT VAPORIZER: when in this position the arrow on the control knob points to the right.

It is the responsibility of the user to rotate the Selector-Interlock control knob to the appropriate position and to set the vaporizer concentration. Always turn the vaporizer control knob to its OFF position, and return the Selector-Interlock Valve control knob to the BYPASS position after vaporizer use.

4.6 Oxygen Flush Operation

The Oxygen Flush pushbutton can be partially depressed for a partial oxygen flush or fully depressed for a full flush at the discretion of the operator.

4/Operation

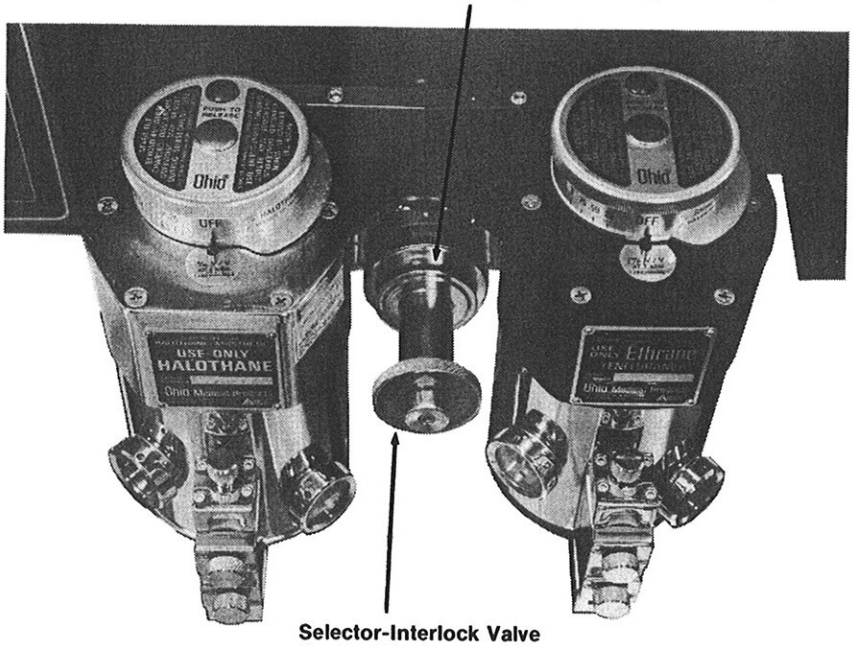


Figure 20.
Vaporizer Selector-Interlock Valve

4.7 Waste Gas Scavenging Interface Valve Operation (if equipped)

When using the Waste Gas Scavenging Interface Valve with a high vacuum disposal system, it is important that the reservoir bag be prevented from filling to capacity. Once the gas flow to the breathing circuit has been established, adjust the vacuum adjustment needle valve so that the reservoir bag oscillates between a half full and a completely collapsed condition during each normal breathing cycle.

When using a passive disposal system make sure the needle valve is completely closed.

4.8 Machine Shutdown

After daily use of the Modulus Anesthesia Gas Machine, turn off all cylinder valves, disconnect all pipeline supplies, and bleed gases out of the circuits by opening all flow control valves. Finally, make sure all flow control valves are completely off (oxygen to its minimum setting), and that the Machine ON-OFF switch is in the OFF position.

4.9 Preoperative Checklist Test Procedures

CAUTION: The headings of this checklist are printed on a plastic card located under the upper drawer cabinet. The card should be reviewed, and all relevant checkout test procedures performed daily.

If the Modulus Anesthesia Gas Machine or accessories do not pass the requirements of the following tests, and the suggested corrections do not bring the equipment into compliance, an Ohio Service Representative must be called to make repairs. The following tests are applicable to Ohio Medical Products equipment only.

In some cases, the user may be referred to the OM manuals accompanying accessory devices.

Verify adequate pipeline supply and reserve cylinder supply (includes leak checkout to Machine ON-OFF switch).

1. Make sure that an appropriate gas cylinder or cylinder yoke plug is properly and securely mounted in each cylinder hanger yoke.

2. Disconnect one end of each pipeline supply hose.

3. If so equipped, disconnect the high pressure ventilator hose at the Power Outlet.

4. Make sure the Machine ON-OFF switch is in the OFF position and that the flow control valves are open one revolution.

5. Open all cylinder valves, one at a time, and verify by observing each corresponding cylinder pressure gauge, that the cylinder supplies are adequate. Note the pressures in all the cylinders. No gas flow should be indicated in the flowmeters. If these conditions are not met, repair is indicated.

CAUTION: Open the cylinder valves slowly to avoid damaging the regulators.

6. Close all cylinder valves and observe each cylinder pressure gauge for at least five minutes to be certain pressure remains constant, indicating no significant high pressure leakage of any cylinder supply gas.

7. Connect all pipeline hoses, one at a time, and verify by observing each corresponding pipeline pressure gauge, that pipeline pressures are normal (nominal 50 psig [345 kPa]).

NOTE: The ventilator hose is to remain disconnected. If pressure gauge readings do not conform to specifications, repair is indicated.

Verify integrity of Modulus Anesthetic gas machine low pressure gas circuitry

1. Check the condition of the Low Pressure Leak Testing Device by doing the following:

Seal the inlet connector of the device and squeeze the bulb until it is collapsed. Release the bulb and observe the time it takes to reinflate. If reinflation occurs in less than 60 seconds the leak test device must be replaced.

2. To Proceed:

A. The Machine ON-OFF switch must be in the OFF position.
B. Open each gas supply either by slowly opening the cylinder valve or by connecting the pipeline supply.
C. Vaporizers or manifold caps must be in position and securely mounted against their manifold locations with the thumbscrew.
D. Flow control valves must be open one revolution.

3. Remove any outlet connector (if present) from the machine common gas outlet. Securely attach the Low Pressure Leak Testing Device to the machine common gas outlet as shown in Figure 10. NOTE: The leak test procedure outlined in step 4 should be performed sequentially under the following conditions:

A. Selector-Interlock Valve control knob in the BYPASS position.
B. Selector-Interlock Valve control knob rotated to select locations with manifold caps (test both locations if two manifold caps are used).
C. Selector-Interlock Valve control knob rotated to select locations with vaporizers mounted - concentration control knob OFF (test both locations if two vaporizers are mounted), and
D. Selector-Interlock Valve control knob rotated to select locations with vaporizers — concentration control knob fully ON (test both locations if the vaporizers are mounted).

4. Squeeze the Low Pressure Leak Testing Device repeatedly until the bulb remains collapsed. Note the time required for the bulb to fill to its normal volume. If reinflation occurs in less than 30 seconds, leakage is excessive and repairs should be made. If the machine does not pass the test in conditions A through C the machine should not be used. If the machine passes the test in conditions A through C, but not in condition D, the leak may be isolated to a vaporizer; in which case, the machine may be used but the vaporizer must be replaced. It is possible that corrections of leaks may be accomplished by tightening the vaporizer filler caps and drain plugs. Repeat appropriate tests after attempting these corrections. Ultimately the leak test must be passed under all applicable conditions for the system to be suitable for use. If not, repair is indicated.

5. When the low pressure leak tests are completed remove the device from the common gas outlet.

IMPORTANT NOTE: The Leak Testing Device's ability to produce a partial vacuum of at least 65 mm Hg should be verified at 6 month intervals by doing the following:

Connect the device to a suitable vacuum gauge and squeeze and release the bulb to obtain progressively greater displacements. If the partial vacuum produced, when the bulb is still deformed, is not at least 65 mm Hg, replace the test device.

WARNING: Do not use the anesthesia machine after performing the low pressure leak test until the vaporizer circuits have been purged with oxygen.

To purge a vaporizer circuit do the following:

1. Rotate the Selector-Interlock Valve control knob to select a vaporizer.

2. Turn the vaporizer OFF.

3. Set a 6L/min oxygen flow (other flow control valves must be closed).

4. Flow oxygen through the circuit for three minutes.

5. Rotate the Selector-Interlock Valve control knob to select the other vaporizer (if two vaporizers are mounted). Repeat steps 1 through 4.

6. Return the Selector-Interlock Valve control knob to the BYPASS position.

4/Operation

Verify proper functioning of gas flow control systems

1. If not already accomplished, do the following:

A. Close all flow control valves to their stops (clockwise). Avoid excessive torque.
B. Slowly open the cylinder valves or connect the pipeline supplies.
C. Turn the Machine ON-OFF switch to the ON position.

2. The oxygen flowmeter scale should indicate approximately 200 ml/min. No other gas flows should be indicated. Conditions other than these indicate repairs should be made.

3. Use tables A and B, as indicated, to confirm proper functioning of the Link-25 Proportion Control Limiting System. Do the checks in table A first. This check must be done using the nitrous oxide flow control valve only and must be performed progressively from low to high flows. Do not overshoot any setting or the test will be invalid.

Table A.

Set N_2O Flow Control Valve So Flow Reads (ml/min)	O_2 Flow Should Read (ml/min)		
		Minimum	Maximum
900	300	236	366
1500	500	394	611
3000	1000	788	1222
6000	2000	1577	2445
9000	3000	2365	3669
12000	4000	3153	4891

Increase oxygen flow to 6000 ml/min after performing the checks indicated in Table A. Then reduce the flow to 3000 ml/min and proceed with the checks in Table B. This check must be done using the oxygen flow control valve only and must be performed progressively from high to low flows. Do not overshoot any setting or the test will be invalid.

Table B.

Set O_2 Flow Control Valve So Flow Reads (ml/min)	N_2O Flow Should Read (ml/min)		
		Minimum	Maximum
3000	9000	7358	11414
1000	3000	2453	3804
500	1500	1226	1902
300	900	736	1141

Do not use the machine if the Link-25 Proportion Control Limiting System does not operate within the permitted ranges as indicated in both Table A and Table B.

4. Adjust all gas flows to a midscale reading.

5. Place the Machine ON-OFF switch in the OFF position. The following should be observed:

A. After a short period of time the Oxygen Supply Failure Alarm should sound and
B. Oxygen flow should be the last to fall off.

If these conditions are not observed, the machine should not be used and repairs are indicated.

Verify integrity of patient breathing circuit

1. Make sure the Machine ON-OFF switch is in the OFF position, but that an oxygen supply is connected.

2. Press the Oxygen Flush pushbutton. Make sure it is operative.

3. Connect the machine common gas outlet to the absorber and connect the breathing tubes and Y connector to form a customary breathing circuit. Plug the open Y connector leg and the rebreathing bag connection (if so equipped, place the ventilator switch valve in the bag position).

4. Close the absorber gas evacuator/relief valve limit turning the knob clockwise to the limit of its travel.

5. Carefully pressurize the patient breathing circuit, using the Oxygen Flush pushbutton, until the absorber pressure gauge registers 40 cm H_2O. Release the Oxygen Flush pushbutton and kink the machine outlet supply tubing to prevent backflow. If the indicated pressure drops more than 5 cm H_2O in 60 seconds, leakage is excessive and if it cannot be eliminated, repairs must be made.

6. Remove the plug at the rebreathing bag connector and install a 3 liter rubber rebreathing bag.

Verify proper functioning of breathing circuit (APL) relief valve

Press the Oxygen Flush pushbutton and vary the gas evacuator/relief valve settings over the entire range. Make sure that the valve is relieving over a range from 60 to 3 cm H_2O by observing the absorber gauge. NOTE: If the gas evacuator/relief valve is equipped with a Maximum Pressure Limiting Stop, the range should be varied from 54 to 3 cm H_2O.

Verify proper functioning of inhalation and exhalation check valves

1. If the Y connector leg is plugged, it should be unplugged.

2. Verify the operation of the inhalation and exhalation absorber check valves.

4/Operation

Verify integrity and proper functioning of vaporizer(s)

Consult the appropriate vaporizer OM manual for procedures other than those described in the low pressure gas circuitry checkout.

Verify adequate vacuum source

1. If not already accomplished, set up the Waste Gas Scavenging Interface Valve for use with a high vacuum disposal system.

2. Open the vacuum adjustment needle valve on the interface valve two full turns.

3. Observe that the vacuum relief valve button on the bottom of the interface valve opens when the vacuum connection is made. Non-opening indicates malfunction; and repair must be made.

Verify integrity and proper functioning of gas scavenging interface valve (Waste Gas Scavenging Interface Valve)

Make sure that the positive and negative relief valves are not sticking by manually pushing the relief valve button at the bottom of the interface valve. Do this several times to verify that neither the positive nor the negative pressure relief valves are stuck in either the open or closed positions.

Verify integrity and proper functioning of ventilator

Consult the OM manual or manufacturer's instructions provided with the specific ventilator being used.

Verify integrity and proper functioning of monitor system(s)

Consult the OM manual or manufacturer's instructions provided with the specific monitoring equipment being used.

5/Maintenance

5.1 Repair Policy and Procedure

A unit which is not functioning properly should not be used until all necessary repairs have been made and the unit has been tested to determine that it is functioning in accordance with the manufacturer's published specifications.

To ensure full reliability, it is recommended that all repairs be performed by an Authorized Ohio Medical Service Representative. However, if this cannot be done, replacement of those parts designated in this manual may be undertaken by a competent individual having general experience in the repair of devices of this nature.

CAUTION: No repair should ever be undertaken or attempted by anyone not having general experience in the repair of devices of this nature.

Such repairs should be accomplished by replacing the damaged part with either a replacement part manufactured or sold by Ohio Medical Products. The unit should then be tested to determine that it is functioning in accordance with the manufacturer's published specifications.

Except for those repairs indicated in this manual, it is recommended that all other repairs be made by an Authorized Service Representative of Ohio Medical Products. Contact the nearest Ohio Medical Regional Service Center for assistance.

If the unit is to be sent to a Regional Service Center, it should be adequately packaged, in the original shipping container if possible, and shipped prepaid. A letter should accompany the unit providing details as to any difficulties experienced and the repairs felt necessary. In all cases, other than where Ohio's warranty is applicable, repairs will be made at Ohio's then current list price for the replacement part(s) plus a reasonable labor charge.

WARNING: Never oil or grease any anesthesia or oxygen equipment unless the lubricant used is made and approved for this type of service. In general, oils and greases oxidize readily, and in the presence of oxygen, they will burn violently. Vac Kote* is the oxygen service lubricant recommended for use. Never cover an anesthesia machine with any type of fabric or plastic covering. Removal of the cover may cause static electricity with the possibility of a resultant fire or explosion.

WARNING: Do not use silicone grease sealants or silicone leak detecting fluids in association with halogenated anesthetic agents. For further explanation of this warning see the Complete Verni-Trol Anesthetic Vaporizer Option OM manual (0178-1701-000).

* Trademark of the Ball Corporation

5/Maintenance

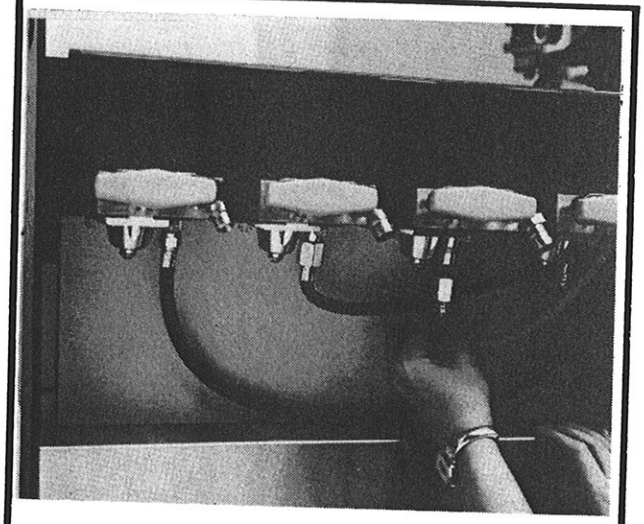


Figure 21.
Disconnecting Internal High Pressure Hose from Gas Supply Module

5.2 Removing and Replacing Gas Supply Modules

1. Make certain the cylinder valve is closed. Open the gate and disengage the cylinder from the strainer nipple. Carefully remove the cylinder. Then back the handle completely out of the gate.

2. Disconnect the pipeline supply.

3. Disconnect the internal high pressure hose from the Gas Supply Module (see Figure 21).

4. Loosen the two recessed socket head mounting cap screws located at the swivel and open ends of the hanger yoke gate. Each screw fits through a spacing cap, the gate, a spacer, the labeled block, the mounting panel and into the Gas Supply Module block (see Figure 22).

Gas Supply Modules:
O_2, 0236-5000-800
N_2O, 0236-5000-801
AIR, 0236-5000-802
CO_2, 0236-5001-800
He, 0236-5001-801

Not Shown:
Yoke Gasket, 0210-6460-300
Yoke Plug, 0206-7129-525
Tee Handle Wrench, 0219-3412-800

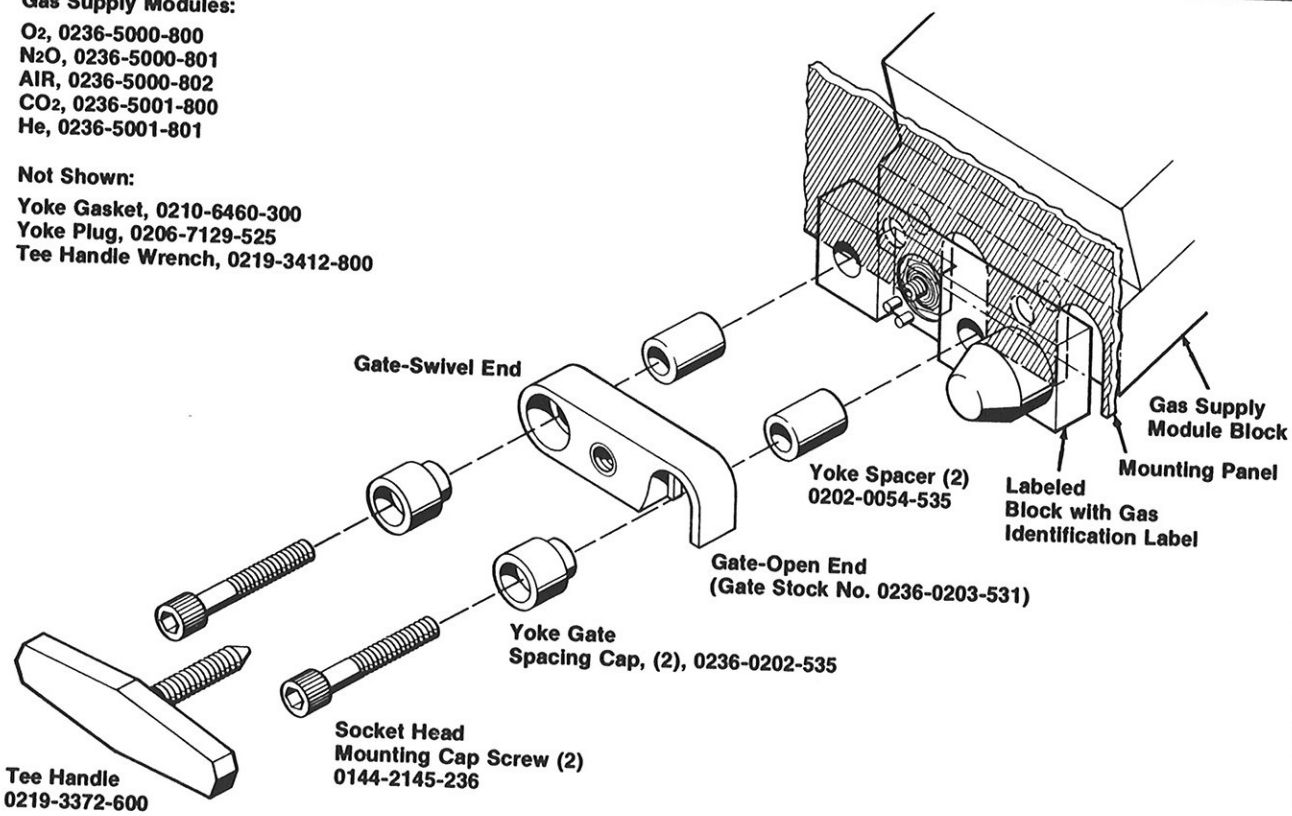


Figure 22.
Removing and Replacing Gas Supply Module

5. While supporting the Gas Supply Module with one hand, remove the mounting screws and gate assembly from the mounting panel and Gas Supply Module.

6. Carefully guide the Gas Supply Module downward from the mounting panel position (see Figure 23).

7. To replace a Gas Supply Module, place it in position on the mounting panel and reassemble the gate assembly as shown in Figure 22. The screws and spacers at the open end of the gate must be replaced first; followed by replacement of the screws and spacers at the swivel end of the gate. Do not tighten the screws until they are both in place and the gate is closed. Minor adjustments may be required to obtain proper functioning of the gate.

8. Reconnect the internal high pressure hose to the Gas Supply Module. Make sure each hose is connected to the appropriate Gas Supply Module.

9. Perform relevant preoperative checkout test procedures before again using the machine.

It is recommended that a replacement for each Gas Supply Module always be available. Defective Gas Supply Modules should be repaired by an authorized Ohio Service Representative only.

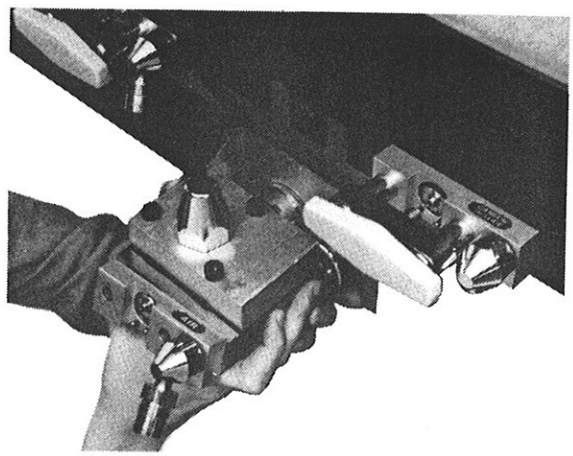


Figure 23.
Removing and Replacing Gas Supply Module

5.3 Access to Flowmeter Modules and FCM High Pressure Hose Connections

To gain access to the flowmeter modules or the DISS internal high pressure hose connections located within the FCM, do the following:

1. Remove the two screws at the lower back of the stainless steel FCM shroud (see Figure 24).

2. Pull the shroud up and angle it slightly to remove.

3. Lift the top shroud from the top of the FCM.

4. Remove the flowmeter shield retainer clips while holding the shield in place, then gently remove the flowmeter shield itself by lifting upward and away from the face of the flowmeter modules.

5. Remove the flow control valve front panel by pulling it forward so that it releases from the Velcro fasteners. Guide the panel out of the notches at each side of the base of the FCM, over the flow control valve knobs and forward until it is released.

6. Reverse the previous procedures when reassembling.

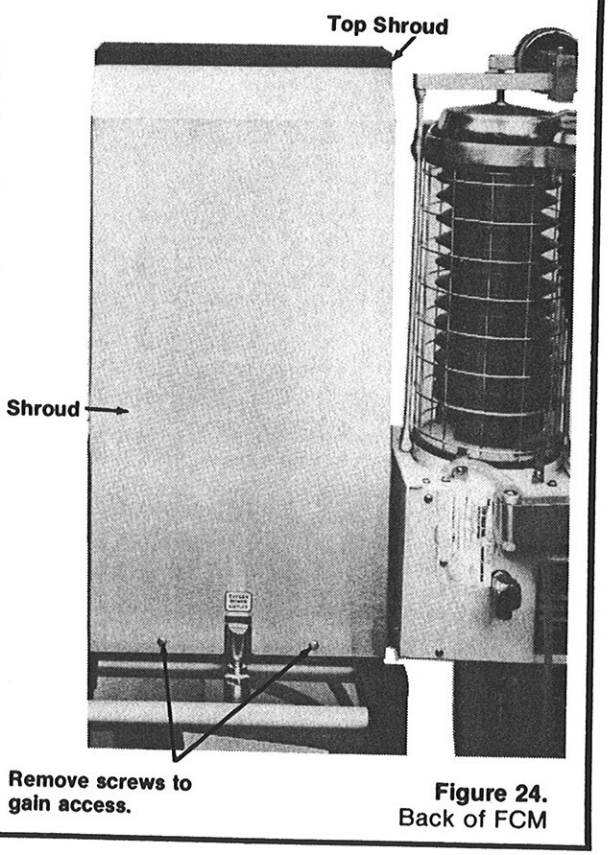
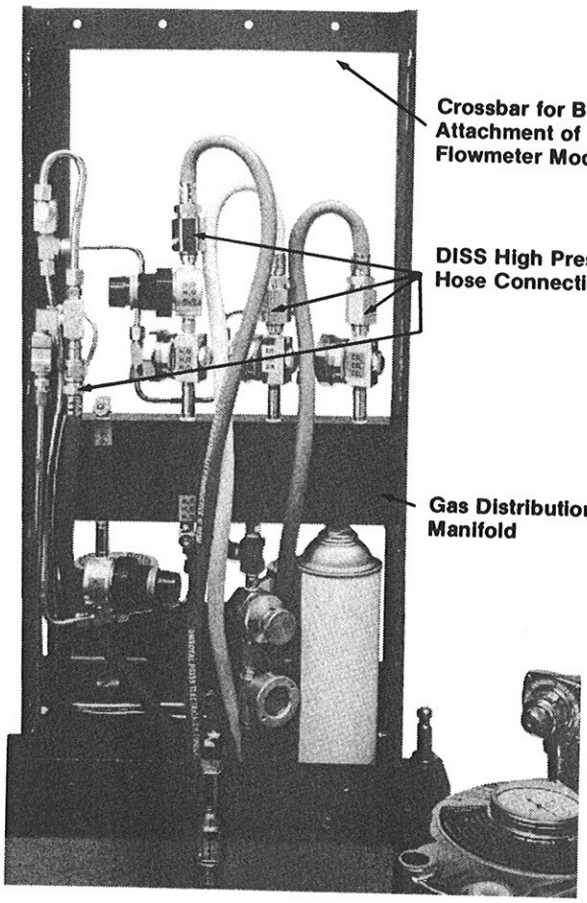
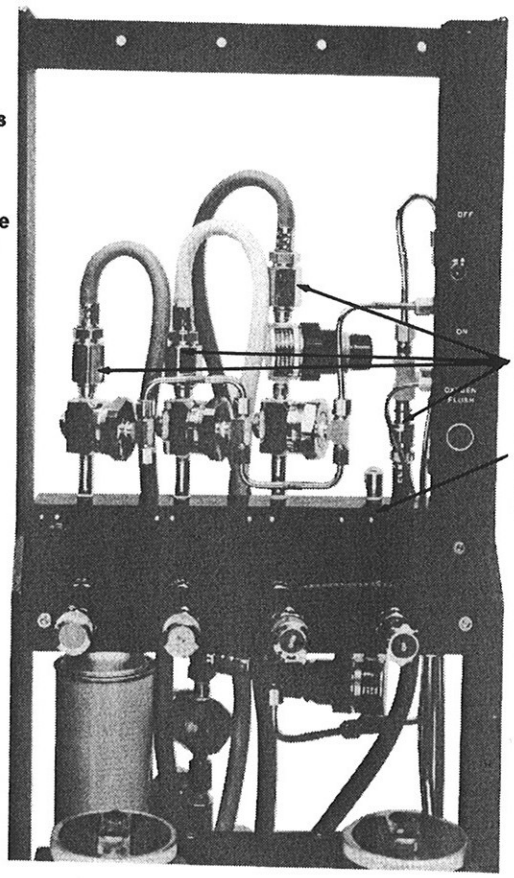


Figure 24.
Back of FCM

WARNING: Gaining access to the flowmeter modules and FCM high pressure hose connections will expose other circuitry and components of the FCM. Never tamper with or attempt to adjust any part of the circuitry unless specific instructions are provided in this manual. To do so may affect the safe operation of the anesthesia machine.





DISS Coded Internal High Pressure Hoses:

O_2, Green, 4.50 ft., 0211-8731-800
N_2O, Blue, 4.50 ft., 0211-8731-801
AIR, Yellow, 4.50 ft., 0211-8731-802
CO_2, Grey, 5.50 ft., 0211-8731-803
He, Black, 5.50 ft., 0211-8731-804

Figure 25A.
Internal High Pressure Hose Connections and Distribution Manifold for Four Gas Machine Rear View

Figure 25B.
Internal High Pressure Hose Connections and Distribution Manifold for Four Gas Machine Front View

5.4 Replacing Internal High Pressure Hose Connections

The coding of internal high pressure hoses makes it highly unlikely that improper connections could be made. If a hose must be replaced, the following checks should be made to insure correct connections:

1. Make sure the color of the hose corresponds to that designated for the gas it will accommodate (except for Helium which uses a black hose and does not conform to the recognized color coding standards).

2. Make sure that the DISS fitting connections are made easily at both the Gas Supply Module and within the FCM.

NOTE: The opposite ends of each internal hose will mate. That they do so is further assurance that the DISS system is intact.

3. Perform relevant preoperative checkout test procedures.

4. Remember to replace the FCM shroud and its retaining screws.

It is recommended that a replacement for each high pressure internal hose always be available.

5/Maintenance

5.5 Removing and Replacing Flowmeter Modules

NOTE: Machines equipped with the complete Verni-Trol Vaporizer option have an additional non-standard vaporizer oxygen flowmeter module installed. This flowmeter module is not to be replaced or repaired by anyone other than an Ohio Medical Products Service Representative. Do not use an anesthesia machine which has a malfunctioning vaporizer oxygen circuit.

CAUTION: The flowmeter modules themselves must never be disassembled. Each module has a seal which, if broken, indicates that tampering has occurred. Tampering with a flowmeter module violates the terms of the user responsibility clause.

CAUTION: A flowmeter module requiring repairs must not be used and must be replaced.

NOTE: It is recommended that a replacement for each flowmeter module always be available.

To replace a flowmeter module do the following:

1. Follow steps 1 through 5 of the instructions for gaining access (see Page 28).

2. Remove the socket head cap screw holding the flowmeter module to the upper crossbar at the back of the FCM (see Figure 25A and 25B). Retain the screw.

3. Remove the two socket head cap screws at the lower front of the flowmeter module. The flowmeter module may have a flowmeter shield support held in place with the uppermost socket head screw (see Figure 26). The shield support must be removed when the screw is removed.

4. Gently pull the flowmeter module forward while keeping it vertical.

5. Make sure that the plastic nipples and associated O-rings located at the lower back of the flowmeter module do not stick in the distribution manifold inlet or outlet. NOTE: Newer model machines have flowmeter modules with captive nipples. Before a replacement flowmeter module is fit in its location, make sure the manifold inlet and outlet are free from obstruction (see Figures 27 and 27A).

6. Take the replacement flowmeter module and fit it in the appropriate manifold location, making sure that:

A. the pin indexing of the module and manifold are compatible,
B. the nipples and accompanying O-rings are in place and in good condition, and
C. the holes for replacing the socket head screws align.
D. the flowmeter module is kept in a vertical position.

7. Install the flowmeter shield supports and socket head screws.

8. Perform relevant preoperative checkout test procedures.

9. Reinstall the flow control valve front panel, the flowmeter shield, the shield retaining clips, the top shroud, the FCM shroud and its retaining screws.

CAUTION: If the flowmeter module in need of repair is for either oxygen or nitrous oxide, and no replacement module is available, the machine must not be used.

If the flowmeter module for any gas other than oxygen or nitrous oxide has a damaged flowtube, the machine

Flowmeter Modules:

O_2, double flowtube 0236-5100-700
O_2, single flowtube 0236-5101-700
N_2O, double flowtube 0236-5103-700
N_2O, single flowtube 0236-5104-700
AIR 0236-5106-700
CO_2 0236-5108-700
He 0236-5110-700

Not Shown:

Flowmeter Module Shield, 0212-1016-300
Flowmeter Module Shield Retainer Clip, 0203-5126-500

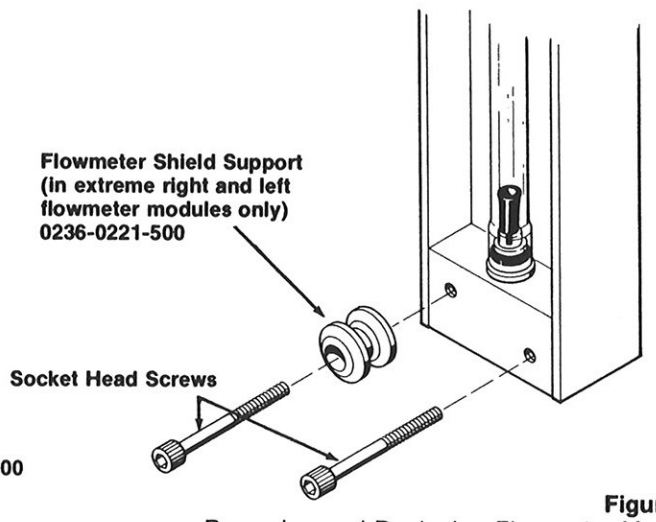


Figure 26.
Removing and Replacing Flowmeter Modules
Front

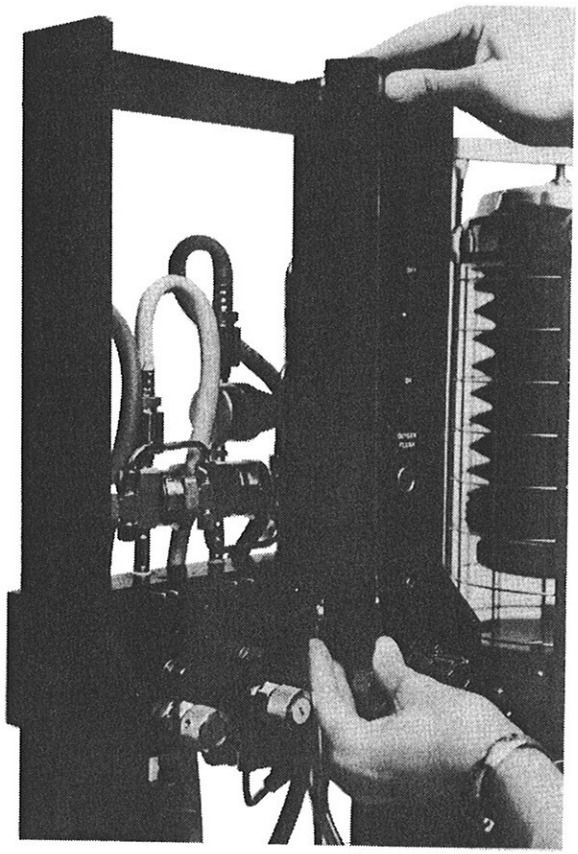


Figure 27.
Removing and Replacing Flowmeter Module

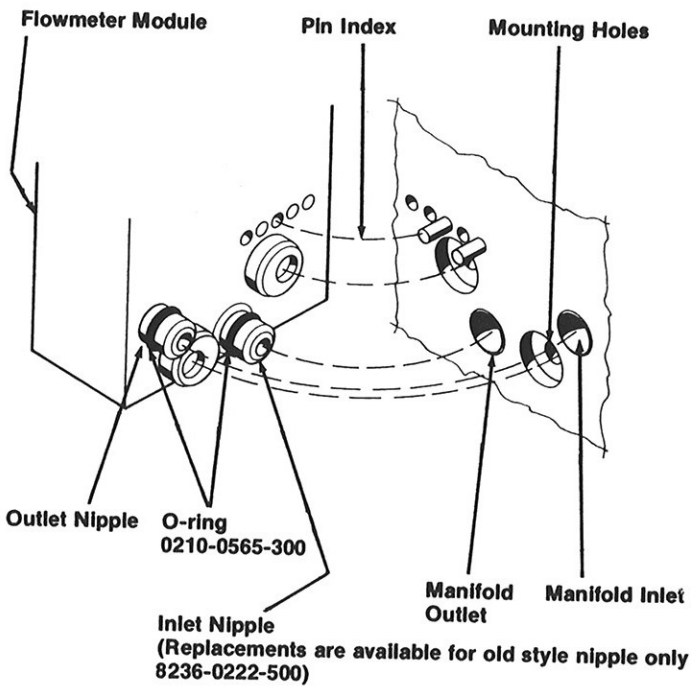
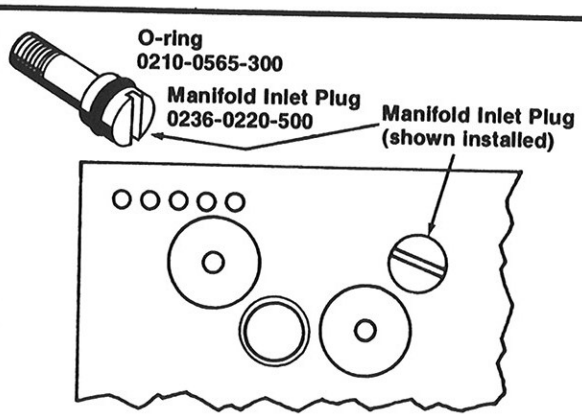


Figure 27a.
Removing and Replacing Flowmeter Modules



NOTE: Never plug an oxygen or nitrous oxide inlet. If these flowmeter modules are absent, the machine cannot be used.

Figure 28.
Plugging Manifold Inlet when Flowmeter Module is absent (AIR, Carbon Dioxide or Helium only)

may be kept in use without a replacement provided ALL the following conditions are met:

A. the damaged flowmeter module is removed,
B. a manifold inlet plug with O-ring (provided with the machine) is installed in the vacant distribution manifold inlet (see Figure 28).

WARNING: Failure to plug a vacant distribution manifold inlet will result in loss of some or all gases from the machine circuitry, because gas from a flowmeter module outlet flows into the common passage of the gas distribution manifold.

C. the respective gas supply is disconnected,
D. the respective flow control valve is closed, and
E. relevant preoperative checkout test procedures are made before using the machine.

If the previous conditions cannot be met the machine must not be used.

5/Maintenance

5.6 Routine Maintenance

WARNING: Never oil or grease any anesthesia or oxygen equipment unless the lubricant used is made and approved for this type of service. In general, oils and greases oxidize readily, and in the presence of oxygen, they will burn violently. Vac Kote* is the oxygen service lubricant recommended for use. Never cover an anesthesia machine with any type of fabric or plastic covering. Removal of the cover may cause static electricity with the possibility of a resultant fire or explosion.

A. Stand

The stainless steel and chrome parts can be kept clean with a damp cloth. Bon Ami* (dry) on a soft towel will restore a high lustre to both, and when applied with a damp cloth, is excellent for removing stains. The enameled surfaces can be cleaned with a damp cloth and Bon Ami, but use of dry cleansers is to be avoided since abrasions of the enamel will result. The gauge window panel should be cleaned with a mild soap solution.

B. Cylinder Hanger Yoke Gates

Occasionally apply Vac Kote lubricant sparingly to the tee handle threads to prolong their life and make sealing of the cylinder gaskets easier. Avoid using wrenches on the tee handle screws.

Always crack the cylinder valve briefly before installing a fresh cylinder. Use a fresh gasket for each cylinder. Open the cylinder valves slowly.

C. Flow Control Valves

Avoid excessive torque when closing valves. A stop is provided to indicate the closed position.

If the flow rate adjustment is uneven, jumpy, unstable or otherwise abnormal, a qualified person should be called to make repairs.

D. Flowmeter Modules

The flowmeter shield, the outside of the flowtubes, and the flowmeter scales may be cleaned with a soft cloth wrung out in warm water. Dry each item thoroughly. Do not use liquid anesthetic agents or abrasive cleansers on the scales since the enamel finish may be damaged.

E. Absorber Mounting Post

This device is intended to operate without lubrication, Clean external surfaces of the absorber post and swivel arm. Use a brush to clean around moving parts. Do not allow liquids to run down between the absorber post and the elevating mechanism.

5.7 Care and Cleaning of Rubber Articles

Rubber goods (natural and synthetic) deteriorate over a period of time, and therefore, must be considered as expendable items which are subject to periodic replacement.

The presence of oxygen, ether, mineral or vegetable oils, phenols, cresols, terpenes, hydrocarbon solvents, chlorinated hydrocarbon solvents, chlorinated hydrocarbons, esters, or oxidizing acids will hasten the deteriorating process.

Rubber articles should be checked often for swelling, tackiness, or cracking. When any of these conditions are in evidence, the affected parts should be replaced.

If conductive rubber goods are involved, the electrical conductivity of the rubber will decrease with age. National Fire Protection Association (NFPA) regulations (pamphlets no. 56A) clearly state the requirements for rubber conductivity.

The useful life of rubber articles can be prolonged by following a program of intelligent use and care. The following suggestions should be carefully reviewed by hospital personnel:

1. Remove metal connectors immediately after use.

2. When possible, rubber articles should be stored in the dark, away from sources of ozone generation such as fluorescent lighting fixtures, electric motors and diathermy machines.

3. Articles that must be stored or steam sterilized in intimate contact with each other can be powdered to prevent tackiness. Talc, zinc stearate, or starch may be used for this purpose.

CAUTION: Talc, zinc, stearate or starch which have been used to prevent tackiness of rubber articles could contaminate a patient's respiratory tract.

* Vac Kote is a trademark of the Ball Corporation.

* Bon Ami is a trademark of Bon Ami Company.

5/Maintenance

A. Cold Sterilization

Rubber goods may be washed with a mild alkali detergent and sterilized in a cold germicidal solution, intended for use with water. Always follow manufacturer's recommendations.

B. Steam Sterilization

Rubber goods may be steam sterilized (autoclaved, at 250°F) for 15 minutes, or boiled for 15 minutes. Avoid super heated steam which causes rapid deterioration of rubber parts.

NOTE: Steam sterilization of masks is NOT recommended.

Following sterilization, allow rubber goods to dry or stand unused at room temperature overnight, in order to regain physical properties.

Drying can be accelerated by heating for two hours at 160°F.

C. Gas Sterilization

Although pressure steam sterilization is the preferred method for the sterilization of rubber goods, an ethylene oxide mixture at 125-135°F can be used. Room temperature sterilization is also effective by exposing rubber goods to 100% ethylene oxide for 12 hours.

CAUTION: Following sterilization with ethylene oxide, parts should be quarantined in a well ventilated area to allow dissipation of residual ethylene oxide gas absorbed by the rubber. In some cases, aeration periods of seven days or more may be required. Aeration time can be decreased when special aeration devices are used. Follow sterilizer manufacturer's recommendations for specific aeration periods required.

Warranty

This Product is sold by Ohio Medical Products (Ohio) under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to the purchase of this Product directly from Ohio or Ohio's Authorized Dealers as new merchandise and are extended to the first Buyer thereof, other than for the purpose of resale.

For a period of twelve (12) months from the date of original delivery to Buyer or to Buyer's order, but in no event for a period of more than two years from the date of original delivery by Ohio to an Ohio Authorized Dealer, this Product, other than its expendable parts, is warranted to be free from functional defects in materials and workmanship and to conform to the description of the Product contained in this operating manual and accompanying labels and/or inserts, provided that the same is properly operated under conditions of normal use, that regular periodic maintenance and service is performed and that replacements and repairs are made in accordance with the instructions provided. This same warranty is made for a period of thirty (30) days with respect to the expendable parts. The foregoing warranties shall not apply if the Product has been repaired other than by Ohio or in accordance with written instructions provided by Ohio, or altered by anyone other than Ohio, or if the Product has been subject to abuse, misuse, negligence, or accident.

Ohio's sole and exclusive obligation and Buyer's sole and exclusive remedy under the above warranties is limited to repairing or replacing, free of charge, at Ohio's option, a Product, which is telephonically reported to the nearest Ohio Regional Service Center and which, if so advised by Ohio, is thereafter returned with a statement of the observed deficiency, not later than seven (7) days after the expiration date of the applicable warranty, to the designated Ohio Service Center during normal business hours, transportation charges prepaid, and which, upon Ohio's examination, is found not to conform with the above warranties. OHIO SHALL NOT BE OTHERWISE LIABLE FOR ANY DAMAGES INCLUDING BUT NOT LIMITED TO INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, OR SPECIAL DAMAGES.

THERE ARE NO EXPRESS OR IMPLIED WARRANTIES WHICH EXTEND BEYOND THE WARRANTIES HEREINABOVE SET FORTH. OHIO MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCT OR PARTS THEREOF.

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